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VIEWS, NEWS AND INTERVIEWS.

An English paper devoted to the plumbing trade, in giving a series of "electric cautions," commits this: "If it is necessary to take hold of two wires at the same time, don't do it."

John Lowber Welsh, president of the Union Traction Company, which controls and operates the consolidated street railways of Philadelphia, announced at a recent meeting of the board of directors his retirement from the management of the company. John B. Parsons, lately of Chicago, and now vice president and general manager of the consolidated roads, will probably succeed Mr. Welsh as president. Incidental to his retirement, Mr. Welsh gave his check to the Episcopal Hospital at Philadelphia, to endow a free bed for employés of the street-car lines who are injured in the course of their employment.

A report comes from London that Mr. Hiram S. Maxim, after many experiments, has produced a 2.8 watt incandescent lamp which will compare favorably in life and maintenance of candle-power with the average 4-watt lamp.

United States Consul Gilbert sends from Liege, Belgium, a report concerning the system of wireless telegraphy developed by Dr. Della Riccia, connected with the Montefiore Institute of Electricity, at Liege. Dr. Riccia has made improvements on apparatus already in use, simplifying it and increasing its power, and claims that he can confine the oscillations of the transmitter to any special point, to the exclusion of all others. In case of communication between war vessels or forts, the message could be transmitted to one alone; in case of fog at sea, the oscillations would not be limited. Dr. Riccia, it is said, can make the presence of a vessel known to another at a distance of 30 miles, and telegraph real messages seven miles.

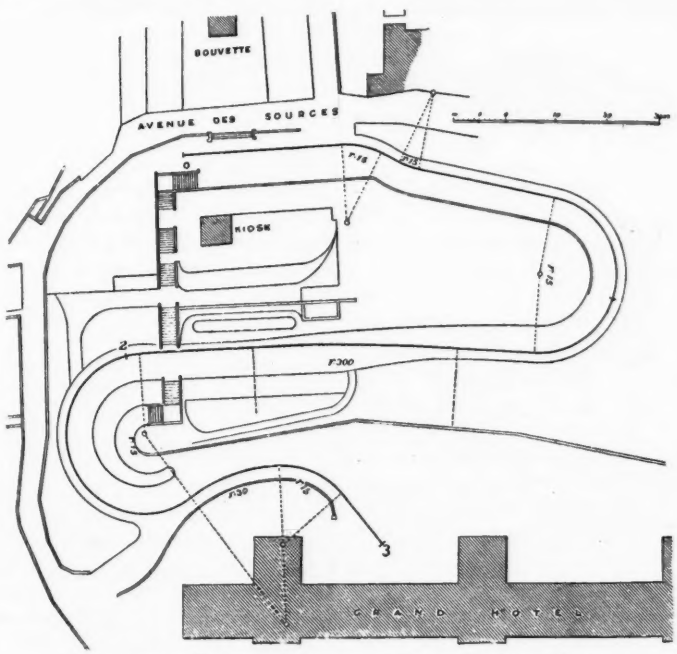
The longest telephone line in Europe will be the one now under consideration between Berlin, Brussels and Paris. There will be double lines, and five-millimetre phosphor-bronze wires will be used throughout. The distance is about 620 miles.

London papers state that, for the recent campaign in the Soudan, two sets of Roentgen-ray apparatus were provided. One of these was to be taken up the Nile by Major Battersby and be established at Abadieh. Considerable difficulty and the greatest care had to be exercised to get the apparatus to the hospital in good order. At Korosko the temperature was between 115 and 120 degrees, but, by dint of keeping the covers of the apparatus damp, it was got to its destination in good order, and, to the great relief of everybody concerned, was found to work well. Major Battersby has the assistance of Sergeant-Major Bruce, R. A. M. C., who has made himself an expert in the manipulation of the necessary complicated apparatus. This will be the main depot for Roentgen-ray work, but Lieutenant Huddlestone, R. A. M. C., has taken a small outfit with six-inch coil to the front. At the request of the London *Times*, Mr. John Le Couteur, a well known expert, of 16 Brook street, Grosvenor square, left recently for Egypt with the Roentgen-ray apparatus to meet Colonel Rhodes, who is on his way from the Atbara to Cairo. Mr. Le Couteur will place his services primarily at the disposal of Colonel Rhodes, and subsequently of others if required.

In Columbus avenue, from Fifty-ninth to Sixty-fifth streets, New York city, there is a section of track on which cars are moved by three different means of propulsion—by horses, by underground trolley, and by cable—while overhead, on the elevated road, run cars drawn by steam locomotives.

The records of the Post Office Department show that there are 102 clerks regularly employed on postal cars running on electric railway lines.

One of the greatest conveniences at Camp Wikoff, Montauk Point, is the electric light plant which furnishes lights for the main thoroughfares and the quartermaster's and commissary department. Westinghouse apparatus is used, and the plant was installed in 12 days by Captain Higgins's signal corps men.



A POLYPHASE ELECTRIC RAILWAY AT EVIAN-LES-BAINS, SAVOY.

A Polyphase Electric Railway at Evian-les-Bains, Savoy.

The Hotel Splendide, of Evian-les-Bains, a fashionable spa on the southern shore of the Lake of Geneva in French Savoy, is situated about 20 yards above the Avenue des Sources, in which the visitors take the waters. In order to save their guests the climb back to the hotel, the Société Anonyme des Eaux Minérales resolved, on the suggestion of Messrs. Lombard-Gèrin et Cie, of Lyons, to build a small electric adhesion tramway as the most convenient and pleasant means of conveyance. The tramway, says London *Engineering*, really corresponds to a lift; the line is very short, only 300 yards in length, but is not without interest. Polyphase currents were selected, in the first instance, because the electricity works supply such currents; and further, on account of the general and special advantages which polyphase motors offer, namely, simplicity in construction and attendance, and the ease with which such motors automatically check themselves on the down run, without requiring any brake.

The track has the appearance of an S, and is formed of double Vignoles rails on steel sleepers. It is a single track without switches or sidings. The average gradient is eight in 100, and the maximum, 10.2 in 100, occurs on the sharpest curve of 15 metres (49 feet) radius. The gauge is 1.1 metre (43.3 inches). The current is taken from two hard-drawn copper wires, six millimetres (one-fourth-inch) in diameter, strung 30 centimetres (12 inches) apart on the brackets of ornamental tubular steel poles. The rails, with their copper bonds, serve as return conductors. The power station of the Cevenos Electricity Works, 13 kilometres (eight miles) from Evian, sends currents of 5,200 volts and 50 periods through one system of primary conductors, both for light and power. A transformer for 30 kilowatts at Evian reduces the tension down to 200 volts for the tramway and for a six-horse-power motor of the hydraulic lift of the hotel. The one motor car rests on a light truck with two axles. The

car weighs 3,800 kilogrammes, or nearly four tons, and has accommodation for 14 passengers, eight of whom find seats. It is handsomely wainscotted and decorated in light maple, mahogany and black-stained pear-tree wood; the seats are made of bent beechwood, also stained black, and cane. Chamois-colored curtains hang before the large plate-glass windows. All metallic parts are heavily nickeled. The floor is covered with rubber, over which oriental carpets are spread. There are two incandesent lamps for the interior of the car and two colored headlights.

The 15-horse-power polyphase motor can temporarily develop 25 and 30 horse-power. The shaft makes 750 revolutions per minute; the conductor is stationary; the starting resistance with its hard steel contact rings and brushes belongs to the armature circuit. The gearing comprises an auxiliary shaft and toothed wheels and chains driving both axles. Each platform is provided with a simple starting device and an emergency current interrupter. Current is turned on in the same way for running up and down hill, and the start is always gentle and the motion uniform.

When descending the motor attains a speed somewhat in excess of the speed which corresponds to synchronism; it then acts as a generator, and sends current back to the mains.

The car carries two trolley poles. One of the trolleys may therefore leave the wire without causing trouble, as the motor would continue to run as a monophase motor, and to act as a brake. When both trolleys jump the hand-brake is applied to both wheels.

The simple sand-box deserves mention. It consists of two concentric cylinders. The outer one is stationary, and is provided with funnels and discharge pipes. The inner cylinder contains the sand, and has a longitudinal slot which is normally on the top of the cylinder. When the lever is turned, sand falls into the funnels; on letting go, the cylinder returns to its normal position. The little tramway was opened for traffic in the beginning of June, and has worked with complete satisfaction since, making on an average 60 double trips daily, at a speed of 10 kilometres (six miles), both up and down. The line was planned and built by Messrs. Lombard-Gèrin et Cie, of Lyons; the motor car and plant came from Messrs. Ganz & Company, of Budapest, Hungary.

TELEPHONE NEWS AND COMMENT.

The American Electric Telephone Company, Chicago, Ill., has increased its capital stock from $100,000 to $130,000.

T. F. Ahern, superintendent of the People's Telephone Company, is making arrangements for the establishment of a telephone system in New Orleans, La.

The Citizens' Telephone Company, Magnolia, Miss, previously reported incorporated, has been granted a franchise by the Mayor to build a local and long-distance telephone system.

The Mississippi Valley Telephone Company and the Dakota Central Telephone Company have entered into an agreement by which the new Minneapolis exchange will have connections with 1,000 miles of long-distance wires in South Dakota and Nebraska.

At the annual meeting of the Albemarle Telephone Company, of Charlottesville, Va., Mr. J. Edwin Wood was elected president and Mr. J. F. Harlan, vice-president. The new board of directors: John B. Moon, J. M. Robinson, P. Leterman, J. B. Andrews, M. Kaufman, W. J. Tyson, S. C. Chancellor, C. B. Stevens and C. H. Walker.

The directors of the American Bell Telephone Company on September 21 declared a regular quarterly dividend of three per cent, payable October 15, to stock of record September 30. The dividend of three per cent makes 10½ per cent declared so far this year, three regular quarterly dividends of three per cent and one and one-half per cent extra declared in June, payable July 15. Books will be closed from October 1 to 15, both days inclusive.

The Pacific states telephone companies, which include the Sunset Telephone and Telegraph Company and the Pacific Telephone and Telegraph Company, of which Mr. John I. Sabin is president, have just placed an attractive card advertisement in 350 street cars on the principal San Francisco lines. These cards inform the public of the fact that on October 1 the following new lines will be completed and ready for use: San Francisco to Eureka, Cal.; San Francisco to Portland, Ore.; Portland, Ore., to Spokane, Wash.; Spokane, Wash., to Boise City, Ida., and Spokane, Wash., to the Canadian line, via Rossland. All these new lines are of double copper wire, of the same conductivity as those in use between New York and Omaha.

On September 20 the Northwestern Telephone Exchange Company completed a telephone deal by which between 500 and 600 towns will be drawn more closely to Minneapolis. These towns are in southern and western Minnesota, northern Iowa and South Dakota. The new bond is established by an alliance between the Northwestern Company and the Western Electric System, the Western Electric Telephone Company, the Minnesota Mutual Telephone and Telegraph Company, and their allied companies. The parties agree that their long-distance lines shall hereafter operate in direct connection. The Northwestern Telephone Exchange purchases the system of the Union Electric Company.

DEFLECTORS FOR STREET LIGHTS.

Deflectors for Street Lights.

Electric light station managers will be interested in a genuine porcelain enamel deflector, illustrated herewith, to be used in connection with the usual metal hoods over incandescent street lamps. This new deflector is produced by the Wheeler Reflector Company, of Boston, to meet the demand for a deflector that is durable and capable of permanently retaining its original finish.

To accomplish this they have placed upon the market a deflector made of heavy iron, completely covered with genuine porcelain white enamel which, as every one knows, is practically indestructible, and always as good as new. It is adapted to the regular 14 inch hoods, made by the Wheeler Reflector Company, so universally used.

That these new porcelain deflectors are destined upon their genuine merits largely to supersede the ordinary painted tin deflectors, heretofore obtainable, is already evident by the hearty reception thus far given them, wherever shown.

Delegates to the Edison Convention.

The following is the list of delegates attending the convention of the Association of Edison Illuminating Companies at Sault Ste. Marie, September 12 and 13: Guests, F. E. Barker, commissioner gas and electric light state of Massachusetts; Henry W. Darling, Edison Electric Light Co.

General Electric Co.: S. D. Greene, John Kruesi, John W. Howell, J. R. Lovejoy, Chas. T. Hughes, B. E. Sunny, F. M. Kimball, Wallace S. Clark, Caryl D. Haskins, Alex. Ekstrom, I. R. Prentiss, F. N. Boyer.

Chicago Edison Co.: Samuel Insull, Martin J. Insull, Louis A. Ferguson, Thomas H. Criden, John F. Gilchrist, Frederick R. Jenkins, Oliver J. Bushnell, Charles G. Y. King.

Edison Electric Illuminating Co., New York: R. R. Bowker, John W. Lieb, Jr., E. A. Leslie, Charles S. Shepard, Arthur Williams.

Edison Illuminating Co., Detroit: Hoyt Post, Alex. Dow.

Edison Electric Illuminating Co., Boston: C. L. Edgar, R. S. Hale.

Columbus Edison Light Co.: A. W. Field, N. S. Browne.

Missouri Edison Electric Co.: Herbert A. Wagner, B. W. Roper.

Edison Electric Light Co., Philadelphia: W. H. Johnson, A. J. De Camp, J. H. Vail.

John J. Burleigh, Edison Electric Light Co., Atlantic City, N. J.

W. S. Barstow, Edison Electric Illuminating Co., Brooklyn, N. Y.

D. T. Nash, Buffalo General Electric Co.

H. C. Fogle, Canton Light, Heat and Power Co., Canton, Ohio.

Samuel Scovil, Cleveland Edison Illuminating Co.

Henry W. Darling, Des Moines Edison Light Co., Des Moines, Iowa.

Chas. Wustenfeld, Elgin City C. and A. Railway Co., Elgin, Ill.

Thomas J. O'Dea, Edison Electric Light and Power Co., Erie, Pa.

C. C. Perry, Indianapolis Light and Power Co.

F. A. Copeland, Edison Light and Power Co., La Crosse, Wis.

W. J. Kehl, Edison Electric Co., New Orleans, La.

H. K. Wood, Piqua Electric Co., Piqua, Ohio.

G. A. Redman, Rochester Gas and Electric Co., Rochester, N. Y.

M. A. Beal, Forest City Electric Light and Power Co., Rockford, Ill.

H. J. Gille, Edison Electric Light and Power Co., St. Paul, Minn.

Wm. Chandler, Edison Sault Electric Co., Sault Ste. Marie, Mich.

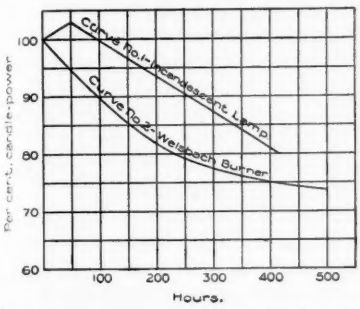
D. L. Huntington, Edison Electric Illuminating Co., Spokane, Wash.

W. S. Smith, Toledo Electric Co., Toledo, Ohio.

E. S Marlow, United States Electric Lighting Co., Washington, D. C.

Depreciation of Candle-Power of Welsbach Mantles.

Gas companies have very generally claimed that the mantles used with Welsbach burners maintain their candle-power practically constant until the mantles are destroyed. Recent investigations, however, show that the depreciation of candle-power in Welsbach mantles is as rapid, or even more rapid than in the filaments of



CURVES OF COMPARISON BETWEEN INCANDESCENT AND WELSBACH LIGHTS.

incandescent lamps. The accompanying curves show the average results of a series of tests made on incandescent lamps of General Electric manufacture and Welsbach burners.

Curve 1 shows that a good 32-candle-power incandescent lamp burns 415 hours before its candle-power drops to 80 per cent of the initial value. Curve No. 2 shows that a Welsbach burner suffers the same depreciation in only 230 hours. In other words, the depreciation of the Welsbach mantle is so much greater than that of the incandescent filament that the Welsbach burner drops to 80 per cent of its initial candle-power 185 hours sooner than the incandescent lamp.

Economy dictates the substitution of a new incandescent lamp when the initial candle-power has depreciated to 80 per cent, but, taking into account the high first cost of Welsbach mantles and the low cost of operation, a mantle would undoubtedly be continued in use until its candle-power had dropped much lower. In this case the customer would be obliged to consume the same amount of gas, and thus be at the same expense, although the light obtained would be much diminished in power. For example, if a Welsbach mantle having an initial candle-power of 32 were burned for 500 hours its candle-power, according to the curve, would drop about 27 per cent, leaving approximately 23.4 candles.

In 1897 tests were made in Berlin in which two English and three German mantles were tested. The standard of light used was the Heffner amyl acetate lamp, in connection with a Lummer-Brodhun photometer, the gas being measured by an Elster experimental gas meter. Much care was taken to secure uniform and reliable results, the room being thoroughly ventilated and draughts at the same time avoided, as it has been found that the light is materially affected if there is not an ample supply of fresh air. The horizontal candle-power was measured in three directions, 120 degrees apart, and the mean taken as the correct reading, the measurements being taken every 24 hours. The final table, which contains practically all the important results, is given here:

	C.-P.		Pc fall.	
Make of mantle.	New	100 hrs.	In 100 hrs.	In 500 hrs.
English mantle, No. 1	36	33.4	14	7.2	61.2
" " No. 2	52.9	49	29.7	7.4	43.8
German mantle, No. 1	70.3	49.7	28.2	29.3	59.9
" " No. 2	83.5	40.3	33.3	24.7	37.7
" " No. 3	62.6	57.1	47.5	8.8	24.1

An important feature in connection with incandescent gas burners is that of the proportion of the size of the mantle to the Bunsen burner. In many cases the mantle is much too large for the burner, and, in consequence, does not become properly incandescent all over; it also shrinks and warps out of shape to a much greater extent than when smaller. Tests also showed that the light absorbed by mica chimneys, as compared with glass, was as much as 9.4 per cent.

Mr. E. A. Medley, who made the report of these tests, sums up as follows:

The mantles give a wonderfully good light when new, but the extreme rapidity with which the light falls off, and the consequent shortness of their efficient life, even when treated with every consideration due to their somewhat delicate constitutions, makes them far from an ideal illuminant. With the possible exception of the German mantle No. 3, a great deal of improvement is necessary before—for domestic lighting, at any rate—they can be considered satisfactory.

The depreciation of candle-power of Welsbach mantles should be thoroughly considered in connection with the heat given out, consumption of oxygen from the air, contamination of the air, inconvenience of lighting, danger from fire and other disadvantages which are common to any gas system, and station managers may find from the facts given above cogent arguments in favor of eliminating these disadvantages by discarding the Welsbach burners for the more convenient and more satisfactory electric lamp.

Mr. Asher Should Now Be Convinced—Discussion Closed.

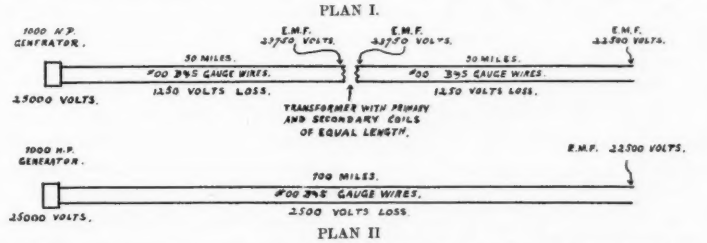
TO THE EDITOR OF ELECTRICAL REVIEW:

It seems hardly necessary to reply further to Mr. James Asher's letter in your issue of September 21, but to prevent the possibility of some neophyte being led astray by his deductions, let us assume two cases:

In Plan I Mr. Asher's method is illustrated, and it is assumed that there is no loss of voltage in the transformer. Starting with 25,000 volts at the generator, an electro-motive force of 22,500 volts is delivered at the end of the line, 100 miles distant from the generator.

In Plan II all the conditions are the same as in Plan I, except that no transformer is used, and we still have 22,500 volts at the end of the line. It is evident, therefore, that the transformer is entirely useless.

If two or more transformers are used, the result is the same. Assuming no loss in the transformers, all the loss involved is due to the heating of the copper in the transmission lines, and the presence or absence of the



DIAGRAMS ILLUSTRATING MR. NOBLE'S LETTER ON ELECTRIC TRANSMISSION.

transformers makes absolutely no difference in the transmission loss or in the possible distance of transmission.

JNO. H. NOBLE.

Pittsfield, Mass., September 23.

Evening Schools in New York City.

At this time of the year many young men who are engaged in business in the daytime are making their plans to study in evening schools. These are the young men who think, and think to a purpose, and are advanced in business by reason of their increased value to their employers.

The Young Men's Christian Association conducts evening classes in commercial, scientific and language courses. At the West Side Branch of the association, 318 West Fifty-seventh street, New York, the opening exercises of the educational classes will be held in the auditorium on Monday evening, October 3, at 8.15 P. M. Rev. J. M Buckley, D. D., will make the address of the evening, and music will be furnished by the Orpheus Mandolin and Guitar Club and Mr. J. Armour Galloway.

The West Side Branch is the most

THE "KRYPTON" SECRET TELEGRAPH SOUNDER.

modern and best equipped building for association work in this country, and on this evening all its rooms will be open to visitors. Further information may be obtained of the secretary, Dr. D. E. Yarnell, 318 West Fifty seventh street.

The "Krypton" Secret Telegraph Sounder.

Mr. J. S. Baynard, 115 Nassau street, New York city, is placing on the market the "Krypton" secret telegraph sounder, illustrated herewith. It has been designed to meet the requirements of secrecy in brokers' offices, stock exchanges, newspaper offices, hotels, railroad offices, etc. It is both a secret and a loud sounder. Its audible readings can be reduced to almost absolute silence and can only be read by the operator using it. When secrecy is not required, a few turns of a conveniently located thumb-screw convert it into a loud sounder.

This device may be used equally well on the main line or on a local circuit. It is made for resistances of from four to 150 ohms. Its use requires no alteration in the telegraph operator's table and it is provided with a head-piece.

CANADIAN NOTES.

BRAMPTON, ONT.—Street lighting; Pearen Brothers, $50 a lamp per annum for 1,500-candle-power lamps.

LANARK, ONT. — The ratepayers defeated the Lanark County Electric Railway bonus by-law. There is now a scheme on foot to connect this town and Carleton Place.

NELSON, B. C.—C. S. Drummond will make application to the city council for a charter for electric railways to be built in the towns in this vicinity. Mr. Drummond represents the British Electric Traction Company, of London, Eng.

FOREIGN ELECTRICAL NEWS.

WHAT THE FRENCH AND GERMAN PRESS HAS TO SAY—ELECTRIC POWER AT THE PARIS EXPOSITION.

Telegraphing by Means of Hertzian Waves—A very interesting application of telegraphy, as carried out by means of Hertzian waves, has lately been tried in Dublin. During the races of the Royal Alfred Yacht Club, the proprietors of the Dublin daily *Express* were able to receive their dispatches by means of this system. Mr. Marconi, who conducted this operation, followed the racing yachts in a tugboat, in the cabin of which was the necessary apparatus used in transmitting the messages. An observer stationed on the bridge signaled the progress of the race, and Mr. Marconi transmitted the report to land. The messages were received by a subordinate at Kingston, a distance of some five or 10 miles from the point of transmission, and from there were telephoned to the journal. All the messages were received in the space of a few minutes after they were sent, and were published in subsequent issues of the paper. The transmission was accomplished without a single hitch, and none of the messages required repeating, the apparatus working satisfactorily throughout.—*L'Industrie Electrique.*

Comparison of Motive Powers—Professor Eberle, of Duisburg, in *Zeitschrift für Electrochemie*, makes a comparison between the three motive powers, water, steam and gas. In the case of hydraulic power the chief thing to be considered is the interest of the capital engaged and the upkeep, but the value of the necessary capital is so variable, according to circumstances, that it is almost impossible to arrive at any reliable results. The author finds that in Germany the cost of an hydraulic installation varies from $25 to $300 per h. p. With steam as with gas, the principal element to be considered is the price of the combustible. Herr Eberle has based his calculation on the installation of 200 to 1,000 h. p., working 300 days of 11 hours each, or 365 days of 24 hours each (which is the case with the electrolytic manufacture of aluminum), consuming coke at 22 cents per ton, anthracite at prices varying from $2.50 to $6 per ton, or coal at $2.50 to $5 per ton. According to the hypothesis of the professor, the yield of the steam machine is 0.35, and the consumption six kilograms, six per horse-power of 200 to 400; and five kilograms, three of 400 to 1,000. For gas, for purpose of comparison, a motor of 200 horse-power and two cylinders was taken. The consumption, per horse-power, was as follows: 0 kilogram, 740 of coke, when coke alone was used, and 0 kilogram, 420 of anthracite; and 0 kilogram, 074 of coke, when coke and anthracite were used together. The advantages, according to Professor Eberle, would appear to be in favor of gas.

The Telephone in Europe—*L'Illustration*, remarking on the number of telephones in service in Chicago and elsewhere in the United States, deplores the lack of readiness to employ these instruments in Europe. In Berlin, where there are 30,000 in use, the average number of calls is not more than seven a day—two in the morning and three or four in the afternoon. Among the European countries, Germany and England hold the lead, with 140,000 and 116,000 instruments, respectively. In France there is scarcely more than 35,000; while there is 62,000 in Sweden, 35,000 in Scotland, and 30,000 in Switzerland. (All these figures as against 700,000 in the United States.)

Electric Railways in the Isle of Man—*L'Electricien* reports an increase in the number of electric tramways in the Isle of Man. The trolley line from Douglas to Laxey was opened about two years ago, and was soon followed by the Snaeffel line, and now it appears that another line has just been opened between Laxey and Ramsey. The new road is 10½ miles in length, making a total of 22 miles of trolley, to which must, however, be added the South Douglas line. On all these lines the overhead system is the one that has been adopted. As the Isle of Man is a favorite resort of tourists, it would seem that these roads are in a prosperous way. The new line includes some of the most picturesque points in the island. It is owned by the Isle of Man Tramway and Electric Power Company, who are also the builders of it.

Automobiles and Lady Drivers—The driving of automobiles by ladies of rank and fashion, according to *L'Energie Electrique*, is becoming quite a fad in Paris. The Duchess d'Uzés is among the first to apply for a license, and doubtless her august example will soon be followed by others of the Parisian "400," who in their turn may be followed by others of less degree. At present the cost of an automobile renders it accessible only to persons of means, but, as was the case with bicycles, this, too, will doubtless in time be arranged to the satisfaction of less fortunate individuals.

The General Electric Company's Works—The last number to hand of *L'Electricien* contains the closing installment of what has been a very interesting paper descriptive of the works of the General Electric Company, at Schenectady, N. Y. The article fully covers the subject, and is illustrated with numerous plans and photogravures.

Electrical Resistance on the Contact of Two Disks of the Same Metal—A paper on this subject was read before the Académie des Sciences by M. Branly, supplementary to his remarks, a few years previous, that two different metals, carefully cleaned and placed on a steel plane, with pressure from above, would offer an important resistance. This, however, is an unusual phenomenon. In certain metals and alloys—copper, zinc, brass, silver, etc., which are precisely those required by the electrician—the resistance at contact is hardly appreciable. In others, such as iron, lead, aluminum, bismuth, etc., the resistance is often great. The object of M. Branly's paper is to prove that two disks of the *same* metal are capable of offering a very noticeable resistance.

Electric Lighting in Glasgow—Very gratifying results are reported of the electric installation in Glasgow, as carried out by the municipal corporation of that city. For the year ending May 31, 1898, the earnings amounted to £36,300, and the expenses to £18,000. The interest paid was £4,818; the amount carried to the sinking fund, £1,537, and the reserve carried over to next year, £217; 1,885,902 units of the Board of Trade were consumed by private subscribers, an increase on the previous year of 50 per cent; for public lighting 228,134 units were used; 150,000 incandescent lamps, each of eight candlepower, were reported as being in service, an increase on the number in use during the previous year of 42½ per cent.—*L'Electricien.*

Electric Power at the Paris Exhibition—The committee charged with the electric affairs of the coming exhibition in Paris in 1900, held, says *L'Electricien*, an important sitting on August 5, under the chairmanship of M. H. Fontaine, the vice-president, in the absence of M. Mascart, the president. The question at issue was the consideration of the report of M. Picou, the chief engineer of the electric installations, relative to the installation and working, in 1900, of the steam and electric machines that are to furnish the exhibition with light and power. In his report M. Picou went over the suggestions made by the special subcommittee previously appointed by the technical committee, and which has already held several sittings. According to these suggestions the general scheme is to have the electrical exhibitors furnish the necessary electricity at the exhibition, dividing the costs among themselves. They are to be allowed to settle the plans for the installation themselves, subject to the approval of the executive committee; they will also be their own constructors, the material employed becoming their property after the exhibition is over. The time during which they will be required to furnish electric power will be from April 15 to November 5, 1900, but the committee reserves the right to extend the time by 30 days. A compensation, which will partly reimburse them for the expense incurred by the installations, will be allowed and they are to receive payment during the time the exhibition remains open. A tariff regulating the amount to be paid has been prepared by the subcommittee and approved by the technical committee. The work of installation must be begun by October 15, and completed by March 15, 1900.

Wireless Telegraphy and Collisions at Sea—*L'Industrie Electrique* gives the following summary of an interesting paper read before the Académie des Sciences on July 8, 1898, by M. Edouard Branly, on wireless telegraphy as applied to the avoidance of collisions at sea: In the case of vessels passing each other at night it is requisite that each should be informed of the approach of the other when still some distance apart. Up to the present a vessel A carrying a wave-transmitter A_t was able to announce its approach to a vessel B supplied with a receiver B_r, but it remained in ignorance of the approach of vessel A. Reciprocity in this case is essential; each vessel must carry a transmitter and one or more receivers; but for the receivers to preserve their sensibility, it is necessary that A_t should not act on A_r, nor B_t on B_r. With powerful transmitters and sensible receivers a simple metallic screen would not protect A_r from A_t, seeing the proximity of the one to the other. We now know that a receiver is not susceptible to the influence of a neighboring transmitter unless it is completely encased in metal. Hence it is easy to

conceive an electric dispositive, such as A_r, may be recovered automatically as soon as the current employed on A_t is closed and reveals itself when A_t stops. A_t thus retains all its sensibility for feeble working and is only impressionable to the influence of B_t. In the same way, B_r will not obey B_t, but only A_t. Operating at intervals sufficiently prolonged, and varying these intervals, vessels in the neighborhood of each other will be able to announce their approach to each other, and this ought certainly to suffice. It would be useful if the directions in which the vessels were moving and the distance between them could be approximately judged. As far as the indicating of the direction is concerned, if the radioconductors were sensible enough to be impressioned at very great distances without their attachments (long rods and soil conductors), one could be placed in a metal cage, open only on one side and movable on a turning support, when the position of the opening would register, on the instance the sound was heard, the approximate direction from whence the waves proceeded (the distance between the transmitter and the receiver being here supposed to be great). This does not differ in any essential point from the reflectors to which Messrs. Berget and Decombe have referred; but owing to the actual necessity for the above-mentioned attachments, the problem remains, so far, unsolved.

ELECTRIC LIGHT FLASHES.

Somerville, Tenn., has voted to issue $10,000 water and electric light bonds.

The Lancaster & Jefferson, N. H., Electric Light Company, with a capital of $36,000, has been incorporated.

The Chicago, Ill., Suburban Water and Light Company has been incorporated, with a capital stock of $600,000.

The Jenney Electric Light Company, of Fort Wayne, Ind., will rebuild the electric light plant recently destroyed by explosion, to cost $160,000.

The Seabright, N. J., Electric Light Company's power-house has been totally destroyed by fire. The building was erected last Spring at a cost of $12,000, and was insured for $8,000. The light supply to the hotels and seaside cottages was shut off.

The Consolidated Light and Gas Company, of Burlington, Vt., has contracted to furnish lights for the city of Burlington for a term of five years for $80 a night. Lights to be of standard 2,000 candle-power each, and to burn all night, every night.

Charles J. Cooper, of Brooklyn, who recently purchased the Hudson, N. Y., street railway, has just closed negotiations by which he also becomes sole owner of the plant and franchise of the Hudson Electric Light and Power Company. The consideration is $150,000.

The Trenton, N. J., Washington Light Company has been incorporated, with a capital stock of $100,000, to introduce in Trenton a system of lighting and heating. Incorporators: E. Raymond Perrine, New York; Forman H. Gordon, Windsor; Irvin Aaron, Doylestown; George E. Fell, Levi P. Updike, Trenton.

The Consolidated Light and Power Company, of Montpelier, Vt., who have bought the water-power known as Bolton Falls, some two miles north of Waterbury village, are to develop the power at once. The contract for the dam and power-house has been let to W. H. Ward & Company, of Lowell, Mass.; work to begin at once. The dam is to be of wood and stone, 48 feet high, with a spillway 160 feet long. The dam is to be 30 feet thick at the base and five feet thick on top. The penstocks which run the water from the dam to the water-wheels will be 11 feet and 9½ feet in diameter. There are to be two water wheels of 1,000 horse-power each. It is the intention of the company to furnish power for heating and lighting purposes to the cities of Barre, Montpelier and the towns of Waterbury and Stowe, as well as for power for various purposes.

A New Street Railway Directory.

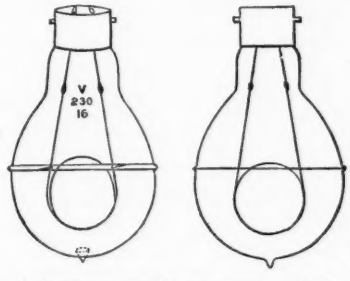
The first number of the "American Street Railway Directory and Buyers' Manual" has been issued by Mr. E. L. Powers. It contains reliable information on the subject indicated in the title, as well as some valuable statistics on track mileage, capitalization and car equipment of street railways in the United States. This directory was formerly a department published as a feature of the magazine *Electrical Industries*, and when that publication was merged into the *American Electrician* the railway and lighting directories were both incorporated into the "Standard Electrical Directory." Owing to the pressing demand, however, for a purely class publication, the "Street Railway Directory" is now printed separately. The subscription price is $3 per year for quarterly issues, and subscriptions may be placed through the Electrical Review Publishing Company, Times Building, 41 Park row, New York.

A Statement from the Westinghouse Company.

A prominent official of the Westinghouse Electric and Manufacturing Company made the following statement last week in behalf of his company:

The election this day (September 22) of Roswell P. Flower and Anthony N. Brady as members of the board of directors of the Westinghouse Electric and Manufacturing Company to represent the interests of the former stockholders of the Walker Company completes the union of the interests of the Walker Company, of Cleveland, with those of the Westinghouse Electric and Manufacturing Company.

The purchase by the Westinghouse company includes substantially all of the outstanding stock, and all but $850,000 of the $2,500,000 of the 20-year bonds of the Walker Company,



A SUPPORT FOR INCANDESCENT LAMP FILAMENTS.

the $850,000 remaining a first lien upon the property.

The recent sale by the Westinghouse company of $3,000,000 of debenture certificates has erroneously been connected with this transaction. The entire proceeds of the sale of these debenture certificates were used in retiring the floating and other debt of the company as previously announced.

The increase in the total yearly fixed charges of the Westinghouse company, due to the purchase of the Walker Company, will be but a little more than the sum that the Walker Company has been expending annually in defending patent litigation instituted by the General Electric and the Westinghouse companies. The acquisition of the Walker Company will, by reason of the agreement of March 31, 1896, between the General Electric and Westinghouse companies, put an end to this patent litigation and very large annual expenditure on both sides.

The business of the Walker Company, as a controlled company of the Westinghouse company, will be entitled to the protection of the patents of the Westinghouse and General Electric companies, and will in all respects be subject to the agreement between these two companies in relation to patents. The Westinghouse company regards the business and good-will of the Walker Company as a valuable acquisition, especially as the Walker Company brings upwards of $1,250,000 of unfilled orders. The Walker Company has, in Cleveland, modern and extensive works, equipped with machinery capable of manufacturing the largest types of railway apparatus, and will, with the works of the Westinghouse company at East Pittsburgh, constitute a manufacturing plant second to none in the country.

The capacity and profits of the two companies will be increased by carefully harmonizing the manufacturing and selling operations, and the direct savings thereby effected should exceed the fixed charges incurred by the purchase of the Walker Company. The shipments of both companies, owing to the large orders on hand, have been increasing during the past few months and exceeded $750,000 for August.

The total fixed charges of the Westinghouse company, including those due to the Walker purchase and the dividends on its preferred stock, will be $42,000 per month.

Support for Incandescent Lamp Filaments.

The accompanying illustration shows a special support for the filaments of electric incandescent lamps, the invention of Mr. Fred Satchwell, manager of the Hiram S. Maxim Electrical Engineering Syndicate, of England. The support consists of a piece of mica with slots or holes in it through which the legs of the filament pass, the scroll of which passes over the tops, thus being held firmly in every position. The special features, says the London *Electrical Review*, are that lamps can be hung in any desired position without the filament falling from the center of the bulbs and touching the glass, which causes fracture, and causes lamps to fail prematurely, especially if placed in other than vertical positions. It further has the effect of so steadying the filament during carriage as to prevent fracture in transit. The whole thing is very simple as the illustration shows. The mica is not sealed into the glass but sprung into two neat slots in the bulb, which hold it firmly. When the lamp is alight the mica can not be seen. During rough usage the filament remains perfectly steady, which is a great advantage for ship lighting. Supports for filaments which have been previously in use have mostly been in wire, which conducts the heat to the sides of the bulbs, and if the wire is not made of platinum causes the bulbs to crack. Where there are two or more scrolls in the filament, or double filaments, as in most high-voltage lamps, it will be found to be of great service as the filaments can not possibly touch one another, causing short circuiting.

The electric light plant at Wahoo, Neb., has been destroyed by fire and is a complete loss.

Electrical Review

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SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue. NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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On another page is printed a mighty interesting paper by Mr. W. J. Clark on "The Electric Railway as an Auxiliary to Coast Defense." Mr. Clark shows that had occasion demanded our electric railway systems along the sea coast could have developed possibilities as rapid carriers previously undreamed of.

It has been predicted that the American Telephone and Telegraph Company will expend $5,000,000 a year, for many years to come, in new construction and improvements of the long-distance telephone system. There is not only the expansion of the long-distance lines south and west to be accomplished, but the duplication of facilities in the East must be cared for to provide for the increasing demand of business men who have learned the economic and commercial value of the telephone as a necessity for rapid transactions.

In a recent decree of the Emperor of China relating to the enactment of patent and copyright laws, it is commanded that:

If there be any subject of ours who should write a useful book on new subjects, or who should invent any new design in machinery or any useful work of art and science which will be of benefit to the country at large, he shall be honored and rewarded by us in order to serve as an encouragement and exhortation to others of similar genius and talent. Or, if it be found that such geniuses have real ability to become officials, we will appoint them to posts as a reward, or grant them decorations or fine raiment in order to show the masses the persons who have gained honor by their talents and genius, while they shall also be allowed to enjoy the fruits of their labors by being presented with papers empowering them to be the sole manufacturers and sellers within a certain limit of time.

Several weeks ago the ELECTRICAL REVIEW mentioned at some length the desirability of an electric railway traversing the principal streets and avenues of the navy yard at Brooklyn, N. Y. The economies which would be achieved by installing such a road are beyond question. As an example, it may be stated that for the work done on ships lying at the Cob Dock the department adds 15 per cent to the cost of the same work done in the navy yard shops. This 15 per cent is added to cover the loss of time incurred by workmen in traveling between the navy yard shops and the vessels lying at Cob Dock. It is probable that in transporting materials between these two points an even greater loss of time is sustained. In times of peace the Navy Department works slowly, but it is pretty certain that some one in authority will be impressed with the advantages of an electric railway in the Brooklyn Navy Yard, and some day it will be an accomplished fact.

TWO SIDES OF AN IMPORTANT QUESTION.

Mr. George Gould, of the Manhattan Railway Company, of New York city, is reported as saying: "I am ready to put electrical power on the elevated railroad system just as soon as we can get a company to guarantee to do the work in a manner that will meet existing conditions and fully supply the public demand for rapid transit without any hitches or delays."

A representative of a prominent electrical manufacturing company says: "There are no particular difficulties in the way of the electrical equipment of Manhattan. The same general conditions prevail here as in Chicago, and if electricity works there, it will certainly work here. We, with other concerns, have frequently submitted plans for such equipment, but none of them has ever received favorable consideration. We attributed this, however, to the fact that the company was not ready for some reason to adopt the new system."

Those who are in search of exact information as to why the New York elevated railway system is 10 years behind the times are recommended to take their choice of the two statements above.

TROLLEY VS. STEAM RAILWAY.

A published interview with President Tuttle, of the Boston & Maine Railroad, has caused considerable comment among steam railroad men. President Tuttle is credited with expressing the opinion that steam roads must practically abandon suburban traffic within a radius of about six miles from the center of every city. This distance he considers practically the limit of trolley line advantages. Trolley cars can do business at five cents where steam roads must charge 10 cents, because the trolley roads get privileges for nothing, that steam roads would have to pay thousands of dollars for. The trolley lines have no terminal expenses either. Mr. Tuttle thinks that the steam roads should improve their service within a zone of from 6 to 25 miles outside of city limits, and would find it profitable to lower rates. In this way the suburbs of the city can be extended.

A NOVEL PETITION IN A DAMAGE SUIT.

A man in Wichita, Kas., was riding in a street car on the line of the Wichita Electric Railway Company. He fell in the car, and has brought suit against the company for $3,000 damages. His case is stated in the following novel language:

"That the said defendants permitted said rails of said street railway system, and particularly upon Douglas avenue in said city, to alternately contract and expand, rust, wear out, separate and spread out of line, so that a car passing over the same at either the minimum or maximum rate of speed, as provided in their franchise, frequently jumps the said rails and glides peacefully over the asphalt pavement of said Douglas avenue in said city, which action of said cars is a standing menace to the citizens of said city, and particularly to strangers who are not familiar with the antics of said defendants' cars, and same is dangerous to comfort, life and limb, as is well known to defendants; that said rails are antiquated and have become so worn, spread and separated, and were so negligently maintained, that said aforesaid cars jump, rebound, jerk and jolt, producing a peculiar seasick feeling, so that passengers compelled to use them keep their seats with difficulty, compelling many to stand to avoid serious injury to their anatomy, so that prudent physicians have advised their patients to cease riding upon or in said so-called passenger conveyances. * * *

"That the wheels attached to said cars are variously abbreviated in that the same are flanged and flat in spots, causing noise resembling a threshing machine working on No. 4 wheat, against the peace and dignity of the inhabitants of Wichita, whereby and wherefore said cars can not be stopped until the flat portion strikes the said aforesaid decrepit rail, ground or pavement, as the case may be, thereby making it difficult for said car again to proceed upon its journey without the assistance of the aforesaid motoneer and the unfortunate passengers. That said cars were so negligently kept that same have become racked and warped, causing some to be convexed, both horizontal and vertical, the spherical surface there of showing apertures through which a person on one side of the car can see a 13-inch shell on the opposite side of the street, compelling the liberal use of tarpaulin and umbrellas to keep out the elements from said aforesaid conveyances some time herein before designated as cars."

About five years ago the ELECTRICAL REVIEW suggested that the underground construction then being installed for the cable railway on Broadway in New York city could be readily adapted to an underground trolley street railway. Such a change is now being made, and it is pretty certain that the cable street railway, in New York city at least, will soon pass into disuse.

The amount of cable and telegraph tolls paid by the government during the war has been enormous. General Miles issued an order last week directing that all messages hereafter shall be abbreviated to the limit and that the wires shall be used only for official business of a pressing nature.

PERSONAL.

Mr. George A. Gardner has given $20,000 to the Massachusetts Institute of Technology at Boston, to be added to the general endowment fund.

Mr. H. T. Eddy, of the General Electric Company, has been appointed instructor in electrical engineering at Union College, Schenectady, N. Y.

Mr. Morgan Brooks, of Minneapolis, has been appointed professor of electrical engineering at the University of Nebraska, at Lincoln, *vice* Prof. R. B. Owens, who has been appointed to a professorship at McGill University, Montreal.

Mr. Charles P. Bruch, of the Postal Telegraph-Cable Company, has been appointed assistant general manager. Mr. Bruch is the able assistant secretary of the company and will continue in that office as well as assist general manager W. H. Baker in his important duties.

Sartaro Oi, of the Department of the Telegraph, and T. S. Horiye, of the Department of Industries, of Japan, were in Chicago last week inspecting the telegraph and telephone systems of that city. Their visit to the United States is of a semi-official character, and relates to the extension of the Japanese telephone and telegraph systems.

Brigadier-General Garrettson, in his official report of the operations of his brigade in the action on the Yauco road in Porto Rico on July 26, commends a number of officers for gallantry and coolness under fire. Among these is Major Webb C. Hayes, of the First Ohio Cavalry, who is treasurer of the National Carbon Company, of Cleveland, and who is well known in the electrical field.

Lieut. George Breed has been detached from the "Yosemite" and ordered home. Mr. Breed, who is a graduate of the Naval Academy at Annapolis, resigned from the service some years ago to enter the electrical field. At the beginning of the Spanish war he re-entered the navy as a member of the Pennsylvania Naval Militia and was given a commission as lieutenant, junior grade. He now returns to his duties in the Philadelphia office of the Westinghouse Electric and Manufacturing Company.

Lieut. T. C. Wood has been detached from the "Gloucester" and ordered home. Mr. Wood is the president of the Ball & Wood Company, of New York city, manufacturers of the well known engines of that name. After some years of active service in the navy, Mr. Wood resigned to enter the manufacturing and engineering field. At the outbreak of hostilities with Spain, Mr. Wood was commissioned a naval lieutenant and ordered to active duty. His part in the Cervera fight as an officer of the "Gloucester" is well known. Mr. Wood's many friends in the electrical field will accord him a hearty welcome home.

ELECTRIC RAILWAY NOTES.

Mr. V. K. Nash, the engineer who had charge of the construction of the Montpelier & Barre, Vt., Electric Railroad, is making a careful examination of the route from Barre to East Barre, Vt., for proposed extension of the Montpelier & Barre Electric road.

The Macon, Ga., & Indian Springs Street Railway Company have purchased the electric light plant of the Macon Gas Light and Water Company, and have made arrangements for the erection of additional buildings, to be equipped with an entirely new plant.

The Kansas City, Mo., Interurban Railway Company has been incorporated; capital stock, $300,000; incorporators, H. G. Pert, Henry Pfeiffer, C. H. Matthews, C. H. Chapin, all of Kansas City. The purpose of this company is to build and operate a standard-gauge railroad from Kansas City to Lee's Summit, a distance of 20 miles.

The report of the Hudson, N. Y., street railway, which recently went under new management, for the quarter ended June 30 shows: Gross earnings, $3,273; operating expenses, $1,898; net from operation, $1,374; fixed charges, $910; net income, $464; cash on hand, $418; profit and loss (surplus), $816. For the quarter ended March 31 the road showed a loss of $289.

The report of the New York & Queen's County Railway, formerly the Steinway, for the quarter ended June 30 shows: Gross earnings, $108,882; operating expenses, $62,926; net from operation, $45,956; other income, $7,240; gross income, $53,196; fixed charges, $63,994; deficit, $10,798; profit and loss (deficiency), $52,624. The net income for the corresponding quarter last year was $87,066. For the March 31 quarter the road reported a deficit of $40,297, as compared with $42,305 for the corresponding quarter the previous year.

The Burlington, Vt., Traction Company have been granted permission by the Board of Aldermen to lay a track on what is known as "the Lower Road," from Burlington to Winooski. The traction company have been trying for more than a year to make arrangements to use this route. The case has been argued in the courts and before the state railroad commissioners, but for some reason no arrangements could be agreed upon until now. This will make a much more desirable route than the present one over the hill. All through cars from Burlington to Essex Junction and Fort Ethan Allen will be run over this new line. Work has been begun, and it is the expectation of the traction company to have the new line open by November 1.

Woodbridge's Wire Computer.

Mr. J. Lester Woodbridge, of the Electric Storage Battery Company's Boston office, has devised and placed on the market an electric wire computer, designed to determine the sizes and weights of wire to carry a given load in amperes, either concentrated at one point or distributed in equal parts at any number of equidistant points. It involves the law of minimum weight of copper for a given drop at the end of the line. One of the advantages of this computer is the ability to compute the weight of copper without necessarily getting at the sizes. The computer is conveniently prepared in a stiff board binding, five and one-half inches square. The price is $1.50, and it may be obtained from the Electrical Review Publishing Company, Times Building, 41 Park Row, New York.

Wall Street and the Electrical Stock Market.

The week just closed has been dull on the Stock Exchange, and there were few features of interest in a professional market. General Electric (old) closed at 49 bid, 49½ asked, an advance of two points over last Saturday. General Electric (new) closed at 82¼ bid and 82¾ asked, an advance of 4¼ points. Western Union closed at 92⅛ bid and 92⅜ asked, a decline of ⅛ point.

On the Boston exchange American Bell closed at 285 asked, and on the Philadelphia exchange Electric Storage Battery closed at 37¾ bid and 38 asked.

Wall Street, September 24.

The earnings for August of the Edison Electric Illuminating Company, of New York, were as follows:

	1898.	1897.	Increase.
Gross	$ 202 516 26	$ 170.347 66	$ 32,168 60
Net	67,692 06	66,222 59	1,469 47
Gross, 8 mos.	$1,940,689 73	$1,561,567 45	$379,072 27
Net, 8 mos.	819,452 13	696,971 61	122,480 52

The Bullock Electric Manufacturing Company and Its Striking Machinists.

TO THE EDITOR OF ELECTRICAL REVIEW:

On March 18 of this year we had a strike of our machinists, which you mentioned in your journal, and to which you have referred once or twice since. This strike has just been declared off, and, as the strike was occasioned by the men fighting for the matter of principle and not for the amount of wages involved nor hours of labor, it might be of interest to manufacturers in general to know the result of this six months' strike.

The strike was against the introduction of the piece-work or premium system in our factory. The system which we employ is practically a premium system, and men are paid by the piece, but piece-work prices are so arranged that the average workman can earn as much if not more than his day wages. If any man regularly falls below the amount of work done by the average man, the assumption is drawn that he is not as good a workman as the average, or that he is careless or lazy, and his regular daily wages are lowered or his services are dispensed with altogether. Our machinists objected to this system, and struck on account of it, although, we believe, a good deal more than the majority of the men who went out did not either understand the system which we expected to adopt nor exactly why they were striking, but were led into it by their labor unions and labor agitators.

Our former employés have called upon us a number of times within the last two months making us propositions to take them back, and we finally agreed to take them back—as we had vacancies which they could fill—they agreeing to work under the system under which we have been running our factory and on account of which they struck.

The result of the strike seems to have been the total loss of wages to the strikers during the last six months and probably a gain of experience on their part, and considerable annoyance on our part, although it is interesting to note that we were able to fill the places of our strikers, and we did more business within the last six months, during the progress of the strike, by several thousand dollars, than ever before in the history of the company. It is, however, not a particularly easy nor profitable way to obtain more business by bringing on a strike, and we should not advise our fellow manufacturers to attempt to increase their business by such methods. Yours very truly,

THE BULLOCK ELECTRIC MFG. CO.,
J. S. Neave, Vice-President.
Cincinnati, September 24.

THE ELECTRIC RAILWAY AS AN AUXILIARY TO COAST DEFENSE.

READ BEFORE THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK, MANHATTAN BEACH, SEPTEMBER 14, 1898, BY W. J. CLARK.

The rapid history making of the past few months has caused the mention of certain problems, which a year ago would have seemed ridiculous, to be worthy now of the most serious consideration. While it is unwise to bring up for discussion here ordinary matters of state and national policy, it is conceded, I think, that, no matter what differences of opinion exist among us on the question of national extension and aggrandizement, there is a unanimous feeling among all Americans that this is now a Nation begun with an exceedingly large "N," and that the true policy for its future is to strengthen it in every legitimate way, by displaying American intelligence, inventive ability and commercial shrewdness in such a manner as to make it the strongest of all earth's nations in peace, so to the better preserve such relationship for all times to come.

Warlike as the title of this paper sounds, its true object is most peaceful, it being simply to advocate the adoption of a broader policy in the granting of electric railway franchises to the end of harmonizing their construction both with other electrical lines, as well as with the general steam railway system of the country, all to the end of strengthening our country in peace that she may be better prepared for war in the future, and thus avoid it.

That improved methods of transportation are equally essential to the commercial development of the country, or to its defense against outside foes, if such country is well populated, is a fact which has been conceded for so long a time as modern civilization has existed. So originality can not be claimed for the theories which are advanced herein, but the development of the railway and the weakness of our seacoast, in certain essentials to defense, so forcibly brought to our attention recently, makes it fitting to call attention here to the importance of the application of the theory in its broadest way to the future development of American electric railways. In this way the marvels which have been performed unconsciously in constituting an important auxiliary to our coast defences may hereafter be made still more valuable by following some comprehensive plan dictated either by the national government or by the executive authority of the various states, working in close harmony to the attainment of a specific end, better adapted to ordinary commercial requirements than the present system of making the procurement of franchises dependent upon the whim of local townships and municipalities. The latter often disregard everything outside their own immediate surroundings, and restrict railway companies from making what would be a natural form of development, which, as recited, would be of the greatest

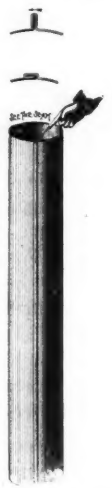


FIG. 1.—METHOD OF MAKING LAPWELDED SPEAKING TUBE SEAM.

importance to the nation in guarding its coasts, should it ever be necessary to do so again.

This application of the general theory is no more original with the writer than the theory itself, for certain of the continental powers of Europe have for several years been encouraging the construction of street railways for the avowed purpose of military expediency, going so far as to grant subsidies or extraordinary concessions where the construction of the line filled in some important link in transportation facilities. The great essential insisted upon has been that in their construction such railways should conform in gauge, special work and curvature with the general steam railway system of the country, so that in emergencies the rolling stock of the latter could be operated over the lines of the former. This would be more especially in the case of besieged cities, to afford a means of ready transportation to all points within the line of fortifications, without breaking bulk; also to make it possible hastily to transport bodies of troops to any points within such district in the quickest possible manner.

While but little has been said concerning this policy in the public press, the work of this character which has been done about some of the European cities is astounding, and is viewed by the military authorities of such countries as being one of the most important steps ever taken in the line of defensive military operations. This being true it requires no argument to demonstrate that a broader application of this plan to our extended seacoast would be of far greater importance than the application of it to Europe, where good roads exist almost everywhere, for, as is well known, much of our seacoast does not enjoy the possession of good wagon roads. On the other hand, the electric lines already reach nearer to very important points along the coast than do the steam lines, while, especially along the seashore of Massachusetts, the electric lines could deliver, if necessary, many more troops in the interior within a given time at such points than would be possible for the steam railways.

All over the United States information is readily obtainable concerning the steam railway systems with their trackage, routes and rolling stock, as well as in their inter-connections and the possibility of temporarily increasing the facilities of any particular road by combination with others. Such was not the condition, however, as regards electric railways when, a few months ago, we were all worrying for fear that landing parties from the then supposed powerful Spanish Navy might make it temporarily uncomfortable at certain exposed points along our Atlantic seaboard, beside destroying much valuable property. It was suggested, therefore, to the writer that he obtain maps of all the existing street railway lines along the Atlantic and Gulf coasts, show their connections and intersections with the steam roads and other street railway lines, and, so far as possible, suggest how much could be done, should military necessity require it, to cause such street railway systems to become an important auxiliary to the steam lines for

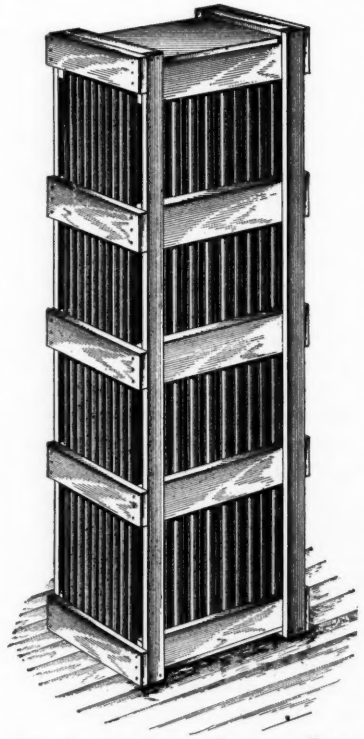


FIG. 2.—A CASE OF SPEAKING TUBE PACKED FOR SHIPMENT.

rapidly moving troops and supplies to any points required along the seacoast. This work involved examination of the possibilities of making connections with the steam lines, the utilizing of such track as would be possible from its type, and the form and character of special work, so that steam rolling stock could, if necessary, be operated over the street railway lines, while the possibilities of using the current of one electric railway to help out congestion upon some other, and all such similar matters, were most carefully gone into. The work was most interesting, hurriedly though it had to be done, and, to the credit of every street railway corporation along the coast, it should be said that each and all patriotically responded to requests with the fullest information that could be desired concerning their systems, and expensive maps were furnished freely without charge. In fact, the management of certain important systems were so enthusiastic that had the War Department requested it, it is probable that many miles of new track would have been built by them without waiting to question the possibilities of its future earning power, or waiting for local franchise rights. Of course, it would not be proper for the writer now to give to the world the entire results of the investigation, but to attain a most important object and to strengthen our electric railway systems where they are weak, it should be said that stretching along the coast from Calais, Me., to Galveston, Tex., are 92 distinct street railway systems, any one of which might have been an important factor in transportation for military purposes should Spain have made a demonstration against our coast. The aggregate length of these systems is about 6,897 miles, and the capacity of some of these for handling traffic to several coast points is simply astounding, it being frequently two or three times that of the steam railways which approach the same localities.

Western Electric Speaking Tube.

In the electrical supply business speaking tube has been so closely associated with electrical signaling devices, bells, annunciators and similar apparatus, that it has been considered one of the necessities for well stocked electrical supply houses.

The Western Electric Company, Chicago and New York, has manufactured speaking tube for a number of years, and a special feature of its product is the lapwelded seam, which is practically air-tight and assists in making the speaking tube rigid and strong. The best grade of tinned sheet iron, known as I. C. tin, is used in the manufacture. The sheet tin is thoroughly uniform in regard to the character of the material and also uniform in shape. Another feature is the careful manner in which the speaking tube is packed, 200 pieces being put in a crate which weighs, approximately, 152 pounds. The 200 pieces are equal to 1,000 feet. The size of a crate is 13¼ inches by 17¼ inches and is 5 feet 3½ inches long, being a convenient size, both in weight and shape, for one man to handle.

In the two illustrations are shown the method of making the lapwelded seam and also how the tube is packed when ready for shipping.

A New Miniature Arc Lamp.

The introduction of the enclosed arc lamp has extended the field of the arc system of electric lighting to interior illumination; the miniature arc of the General Electric Company promises another advance in providing for the use of arc light in smaller units so that it may compete with oil, gas and incandescent lamps in illuminating halls, offices, display windows and rooms of limited area.

FIGS. 1 AND 2.—A NEW MINIATURE ARC LAMP.

Heretofore arc lamps have been designed to give an intensely bright light, and they naturally required considerable current. For certain installations such lamps are not desirable. With low-ceilinged rooms an intense light over-illuminates the area directly beneath it, while other parts of the room are left comparatively dark. In the General Electric Company's new miniature arc lamps, the illuminating power and the current are much less, so that several lamps are not more expensive to operate than one large lamp, while by dividing the total amount of light required the general illumination is greatly improved. The miniature arc lamp is also suitable for other places where a large arc lamp would supply more light than necessary. It is of the single globe and reflector type, the light of the arc being thrown down from the polished under surface of the reflector.

This miniature arc lamp, designed for 110-volt direct current circuits, is frequently required to operate at slightly higher or lower voltages. An adjustable resistance has therefore been provided in the top of the casing which adapts the lamp to any line voltage from 100 to 120. The standard current required by the General Electric miniature arc lamp is two and one-half amperes, but a loop in the magnet coil permits an adjustment for three amperes; 73 to 75 volts are required at the arc, and when adjusted for two and one-half amperes with a line voltage of 110, the energy at the terminals is 275 watts. Adjusted for three amperes the energy is 330 watts. The life is from 40 to 45 hours with standard current, and from 35 to 40 hours with three amperes

The mechanism of the miniature arc lamp operates on the well known General Electric carbon-feed principle.

The carbon is fed through a brass tube extending through the center of the magnet coil. The double-cam clutch, which operates directly upon the carbon, is simple in its action and has few parts. Special attention has been given to the design of the carbon-holders and the general arrangement of the frame to facilitate rapid trimming.

Figs. 3 and 4 show the striking contrast between the size of the miniature lamps and that of a lamp sold for interior illumination a short time ago.

The principle dimensions of the miniature arc lamp are:

Length over all	18¼ inches.
Weight	9½ pounds.
Upper carbon	8½x⅜ inches.
Lower carbon	3½x¾ inches.
Enclosing globe—top diameter	2 inches.
Maximum "	2 inches.
Bottom "	⅛ inch.
Height	4 inches.
Porcelain shade	11x2x2⅜ inches.

No outer globe is used. Each lamp is arranged with a switch so that it can be readily thrown in or out of circuit. Several hundred of these lamps have been introduced among central stations in the past 60 days, and there seems to be an increasing demand for arc lamps of small and attractive design.

A Corrugated Trolley Pole.

In the illustration herewith is shown a corrugated trolley pole patented by Mr. H. W. Smith, manager of the railway department of the Bibber-White Company, Boston, who have the sale of it. The pole is made of cold-drawn seamless steel taper tubing and then corrugated. The corrugation adds great strength; it places less tension on the spring and trolley base, and therefore less pressure on the trolley wire, thus reducing the wear and tear on the trolley wheel and wire. These poles will be made in all sizes. The weight of an ordinary steel pole is from 20 to 25 pounds. The weight of an ordinary pole made from steel tubing is from 15 to 18 pounds. The weight of the new corrugated steel trolley pole is from 12 to 15 pounds and is much stronger than either of the above.

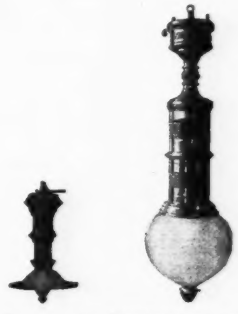
This corrugated tubing was tested at the government arsenal at Watertown and shown as follows: "A piece of ordinary weldless tube was tested against a piece of corrugated tube of the same length, weight, gauge and diameter, the conditions being exactly the same. The ordinary tubing stood a transverse test of 850 pounds before giving way, while the corrugated tubing resisted a strain of 1,300 pounds before the limit of elasticity was reached. In a compression test the ordinary tubing stood a pressure of 6,100 pounds, while the corrugated tubing stood 8,600 pounds in the same test."

A CORRUGATED STEEL TUBING TROLLEY POLE.

WINNIPEG, MAN.—A local company is said to be ready to utilize a part of the water-power of the Winnipeg River. The project includes the building of an electric railway, from the mouth of the Whitemouth River to points on the Winnipeg River.

A Morse Story.

To illustrate the kind of lapse of reasoning power from which great inventors are known to suffer, an old story in the life of Morse has been revived by a daily paper. When his great invention of "distance writing" was about completed he wanted the B. & O. Railway Company to try it. To get rid of him the president of the road turned him over to a subordinate. This official was struck with the beauty of the invention, and became so interested in it that he sat up half the night discussing it with the inventor. At length Morse confessed there was only one thing which baffled him. "As long as the railroad runs," he said, "where poles may be erected, it will be easy sailing, but when we come to the big bridges, what is to be done then? We can't erect poles across the stream, and without them the wire would sag and perhaps break from its own weight. I confess I don't know what to do. Can't you suggest a way out of the difficulty?"



FIGS. 3 AND 4.—COMPARISON IN SIZE BETWEEN MINIATURE AND ORDINARY INTERIOR ARC LAMP.

"Why don't you fasten the wires to the bridge?" asked his companion, without a moment's hesitation. For a moment Morse gazed at him with open mouth and then exclaimed: "Why not, indeed? Why, I never thought of that. It's the very way."

The eastern syndicate, headed by Manchester Haynes, Mayor of Augusta, Me., which bought up the street railway and the gas and Thomson-Houston electric light plants at Quincy, Ill., bought up the Empire electric light plant, a new concern. The price paid is said to be in the neighborhood of $70,000.

COST OF ELECTRIC POWER FOR STREET RAILWAYS AT THE SWITCHBOARD—STEAM AND WATER-POWER.

READ BEFORE THE AMERICAN STREET RAILWAY ASSOCIATION, BOSTON, SEPTEMBER 9, 1898, BY R. W. CONANT.

It is my privilege to be able to communicate to you facts and figures bearing on the operation of 44 power stations located at the important street railway centers throughout the country. These figures cover for the most part the operation of the stations during the past year, and were obtained through the kindness of members of this association, as well as from experience on the roads in Boston. The aggregate capacity of power stations represented is 98,387 kilowatts or 131,800 electrical horse-power.

The total cost of operation for the production of power alone from these stations during the past year has been $1,825,000, and *if* the power had been produced by all at as low a cost as it was in a number of the more economical stations the saving for the year would have amounted to $443,300. It is the chief purpose of this paper to explain the if, and to obtain some idea of its size.

In what has been published on this subject there are a great variety of opinions as to what should be included in the cost of power, and also as to whether the basis of comparison should be the car-mile or kilowatt-hour, this latter being due to the fact that, up to within a few years, there has been no reliable instrument adopted by street railways for the measuring of their output.

The car-mile basis is not a fixed standard. A car mile up hill takes a great deal of power, while a car mile down hill should take none, and may be made a source of power.

In the analysis of costs of operation of power stations of various sizes and types it is first necessary to adopt a standard for the unit of power. We have seen that the car-mile is unreliable. Recording wattmeters are at present constructed which will measure the output in kilowatt-hours. They can be made to give results which are accurate within a very few per cent. This statement is abundantly verified by actual experience, and is gradually becoming universally recognized. It is no doubt difficult for one who has been accustomed to figure cost of power production on a car-mile basis to reconcile himself to the kilowatt-hour. It should, however, be very easy for the steam engineer, who is accustomed to deal with horse-power, since the kilowatt-hour equals 1.34 electrical horse-power hours.

It was evidently the idea of your executive committee in limiting the title of this paper to cost at the switchboard to abolish the car-mile and adopt the kilowatt-hour as the unit of power. And in comparing the costs from the various stations I shall use this unit. For the benefit of those who are accustomed to considering the costs per car-mile it will be interesting to know that on many roads a car-mile takes just about one kilowatt-hour. This is not true where grades and equipments are extremely heavy; in such cases two or three times this amount may be required.

In the costs of power, whether it is produced by steam or water, should be included the fixed charges as well as the cost of operation. Under fixed charges are interest, depreciation, insurance and taxes on the capital invested in the land, buildings and machinery of the power station. Under operating expenses are fuel, labor, supplies, repairs, superintendence and general expense. In both the fixed charges and operating expenses the component items vary between widely different limits and it becomes impossible to construct a law that will predict the cost under all circumstances. On the other hand, for one who has had experience it is comparatively easy to predict what the power ought to cost under a given set of conditions. What it will cost must, of course, depend on management as well. In view of the variety of the circumstances governing these costs I have deemed it advisable to establish for purposes of comparison a standard plant whose conditions are fixed.

It is not my intention to imply that the performance or equipment of this station, which I shall employ as a standard, is ideal or could not be bettered, but rather to assume equipment and performance based on facts obtained from stations in actual commercial operation during a long period of time. As this station is described, its performance may seem to border on the ideal, and there is no question but that its performance is consequent on favorable circumstances, very nearly, we may say, test conditions. It is, however, in my opinion, best to err on this side rather than on the other in establishing a station for comparison.

I shall assume the station to be located on the water-front, the exact spot is unimportant, but since this association has chosen Boston as its meeting place we can consistently locate the station here as well. I have fixed the capacity at 3,600 kilowatts. The building erected on firm ground, requiring but little piling or filling; building and chimney of brick.

For equipment, three cross compound condensing engines, cylinders 28 inches and 56 inches by 5-foot stroke, speed 80 revolutions per minute, steam pressure 150 pounds, three 1,200-kilowatt, direct-connected generators, six water-tube safety boilers, 500 horse power each, economizers and exhaust feed-water heaters, electrically driven feed pumps and coal handling apparatus. Such a station would cost to install as follows:

CAPITAL INVESTED.

Building, foundations for engines and boilers, chimney, coal handling apparatus	$120,000
Engines and condensers, heaters, separators and piping	91,800
Feed pumps and economizers.	18,000
Boilers and flue connections, complete	61,000
Generators and switchboard, complete	73,800
Land and docking facilities.	17,000
Engineering and sundries	5,000
Total	$386,600

or about $107 per kilowatt capacity.

To obtain the figure for fixed charges I assume interest at six per cent; insurance and taxes, three per cent; depreciation, two per cent; total, 11 per cent; which makes an annual fixed charge of $42,526.

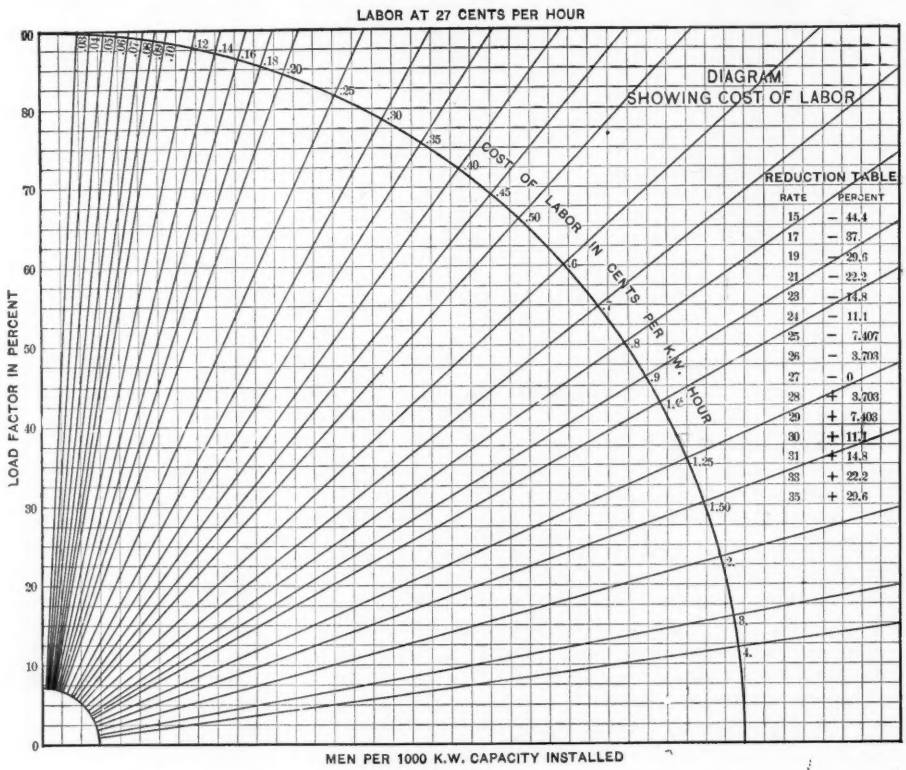


FIG. 1.

I shall assume that this station produces 10,500,000 kilowatt-hours per annum; dividing the annual charge by this figure gives four cents per kilowatt-hour for the fixed charges. The depreciation is not intended to cover repairs, which will be included under operating expenses. The two per cent assumed for depreciation is to establish a sinking fund against the time when the station will have to be entirely replaced by one of more modern and economical design. Time of replacement being taken at fifty years. A few years ago the time of replacement should have been assumed much shorter, owing to the imperfect design of power station apparatus then existing. But with the present advanced state of the art improvements can not be expected to develop as rapidly.

Before arriving at the cost to produce power from this station, it will be necessary to obtain the operating

expenses. In making comparisons between stations of different sizes and types the cost of labor is the most perplexing item.

Some stations operating with two shifts, others three. Some have engineers paid at different rates, and men which appear on the records of some are in a capacity which in others is absent or replaced by men of another class and rate of pay. I therefore give the following method of analysis of the labor item, which gives satisfactory results when applied to station operation.

I can illustrate the method and at the same time derive the operating expenses by applying it to our standard station. It is assumed that this station operates with three shifts of men, the duration of each shift being eight hours. This makes the shift-hours per day 24 or 8,760 for the year. The same number of shift-hours would, of course, be obtained by two shifts of 12 hours each, as is the case with some stations. For the three-shift station, the first two probably would have the full complement of men, while the third would not, as the station might shut down on that shift. But as there is considerable inspection, cleaning and overhauling, this shift requires almost as many men, though their rate of pay may be less. The highest rates of pay would be on the shift of heaviest load. The crew to operate the standard plant would be about as follows: Two engineers, one oiler, one helper, two firemen, one coal passer; total, seven men per shift.

The average rate of pay per man is taken at 27 cents per hour. This would be calculated from an actual station by dividing the total amount paid for wages, including chief engineers' salary, by the product of the number of men operating with the hours each has worked. The number of men per shift for this station being seven, I will divide this figure by 3.6, which is the figure expressing the capacity in 1,000-kilowatt units. This division gives 1.94 as the number of men per shift per 1,000 kilowatt capacity. This figure will vary with the type and size of station, as we shall see later. The fractional part of the man, of course, only appears in figuring.

Multiplying the 1.94 by the rate of pay, 27 cents, gives 52 cents as the cost of labor per hour per 1,000-kilowatt capacity. This multiplied by 3.6, the number of 1,000-kilowatt capacity, gives $1.87 as the total cost of labor required to operate the station per hour.

It will further aid in the analysis of the labor item to introduce the load factor. As this term is sometimes employed in a different sense from that used in this paper, I shall define it to be that per cent which, when multiplied by the capacity of the station in kilowatts and by the shift-hours for the period, gives the kilowatt-hours' output for the time considered. I take as the load factor of this station, 33.3 per cent. average for the year. You may remember that in the consideration of the fixed charges I gave as the kilowatt-hours per year 10,500,000, which is 33.3 per cent of 3,600 kilowatts multiplied by 8,760, the shift-hours per annum.

It has been shown above that $1.87 is the average cost of labor to operate the station for one hour, and if we obtain the average kilowatts during the hour, which is kilowatt-hours for that period, a simple division will give the figure for the cost of labor per kilowatt-hour. The load factor gives the means of obtaining the kilowatt-hours, and by multiplying 3.6 by 1,000 and 33.3 per cent gives 1,200 as the average kilowatts for the hour, or kilowatt-hours for that period. Dividing $1.87, cost of labor to operate the station per hour, by 1,200, gives .157 cent as the cost of labor per kilowatt-hour. But 3.6, the figure representing the capacity, was used as a multiplier in obtaining both the cost of labor, $1.87, and 1,200 kilowatt-hours. It therefore disappears in the division, and the expression for the cost of labor per kilowatt-hour is made independent of the capacity of the station to that extent. The rule then for obtaining the cost of labor per kilowatt-hour for any station is to multiply the rate of pay of the men by the number of men per 1,000-kilowatts capacity and divide by the product of the load factor and 1,000.

The use of this method will be illustrated if we compare the cost of labor per kilowatt-hour in the first two columns of table No. 1. It is .157 for the standard and 56 cents for station No. 1. It is rather difficult to account for this great increase until we notice that the men per 1,000 kilowatts is 4.7 as against 1.94. The rate of pay and load factor also enter, as I shall show later.

I have constructed a diagram, which gives the results of this expression for cost of labor for all usual rates of pay, load factors and men per 1,000 kilowatts. This diagram is based on a rate of 27 cents per hour, and there is also given a reduction table, which gives the per cent to be added or subtracted for other rates than this. To illustrate its use, suppose we have a station whose equipment requires five men per shift per 1,000-kilowatts capacity. During a month of high output it might operate at a 30 per cent load factor. On the diagram following 5 up to 30 gives cost of labor at 45 cents per kilowatt-hour. In a lighter month the station might operate at a 15 per cent load factor. Following 5 up to 15 gives nine cents, or twice as much for labor per kilowatt-hour.

To further illustrate the use of this diagram, let us consider that the equipment of our standard station is cut into so many units that it required 3.7 men instead of 1.94. Price of labor and load factor being 27 cents and 33.3 per cent respectively; 3.7 followed on the diagram up to 33.3 per cent gives .3 of a cent, as against .157 cent for standard.

The cost of fuel is the next item to be considered in the operating expenses of the standard station. Considering coal as the fuel used, its cost per kilowatt-hour depends on the price per ton and on the efficiency of the station, which is best expressed in pounds coal consumption per kilowatt-hour. The coal for standard station I have assumed to be clear bituminous, costing $3 per short ton delivered.

As to the efficiency, I am able to quote from tests in which I was personally engaged on a station of the same size and similar equipment. The duration of the test was forty-five hours, made under actual conditions of railroad service during the day, and at night the load was kept on the station by means of a water rheostat. I will say here, however, that the test on the steady night load did not show any great gain in efficiency, due to the fact that the day load of the station was steadied by feeding in with others. The average efficiency of transformation, indicated horse-power to electrical horse-power, at the switchboard was 90 per cent. The steam consumption of the engines was 14.5 pounds per indicated horse-power hour. This record on a later test has been lowered. The boiler evaporation was 9.4 pounds water pound of coal from actual conditions. The coal used was New River bituminous. The economy of the station, represented by the coal consumption in pounds per kilowatt-hour, was 2.3. I have assumed 2.2 for this figure for the standard station.

(To be continued.)

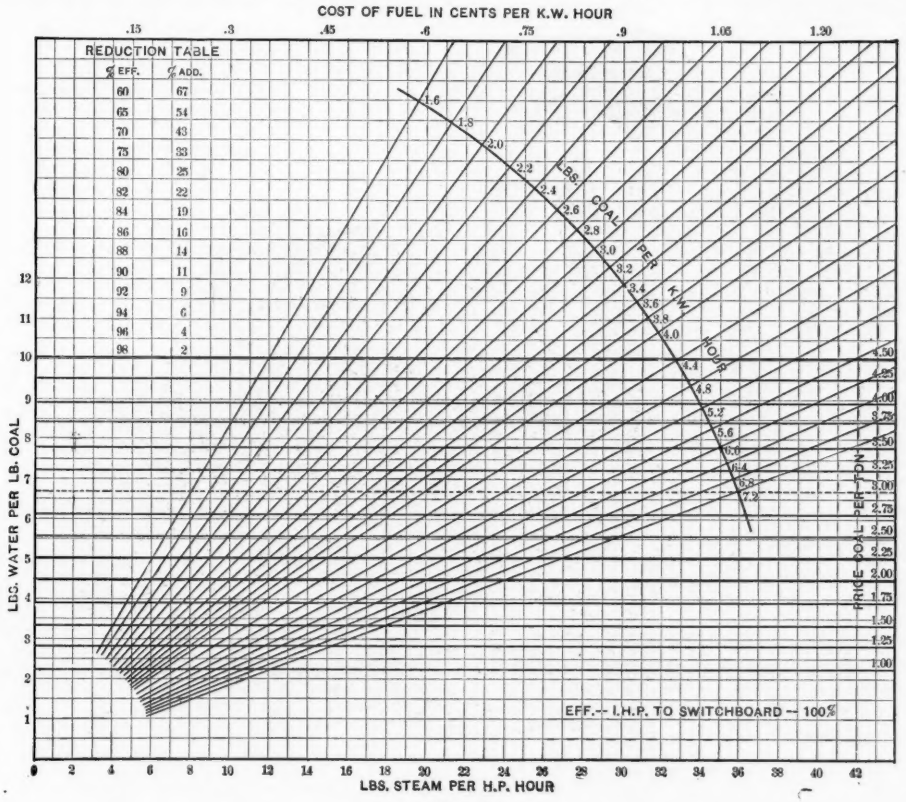


FIG. 2.

American Institute of Electrical Engineers.

The 127th meeting of the Institute will be held at 12 West Thirty-first street, New York city, on Wednesday, September 28, at eight o'clock P. M. A paper will be presented by Charles P. Matthews, of Purdue University, Lafayette, Ind., on the "Photometry of the Enclosed Alternating Arc."

Development and Construction of Modern Direct Generators.

Until electricity is obtained from coal by "direct conversion," dynamos directly connected to steam or other thermal engines will probably remain the best means for obtaining current from this great source of energy. Such combinations are the most compact, safest, most easily cared for, and simplest of all arrangements of generators, and have therefore merited the most thoughtful attention with a view to bringing the types adopted up to the highest state of perfection.

At first the direct arrangement was not generally looked upon with favor, and the pioneers in this style of construction had much to contend with in its introduction. The designs made about 15 years ago by the Bradley Electric Power Company, since absorbed by the Crocker–Wheeler Electric Company, were for, perhaps, the earliest machines of this type brought out. The importance of direct dynamos was thus early recognized, and the type has since been under constant development by the Crocker–Wheeler company, who, believing that only the best would survive, have made, after considerable remodeling based upon experience, a line of direct machines of the most careful design.

The advantage of direct dynamos and motors lies, not in greater efficiency, but in simplicity, economy of floor space, ease of management, quiet running and avoidance of belting.

The determination of the best number of poles (all sizes of direct dynamos made in the factories of the company mentioned are of the multipolar type) to use for obtaining maximum efficiency at the minimum complication and cost has been made with great care. It is well known that the fewer the poles and field coils the greater is the economy of copper for a given excitation. But, in order to run sparklessly and to give a machine an unchanging neutral space for commutation, it is necessary that the length of the air-gap bear a certain ratio to the reactive power of the armature conductors under the pole. The larger the machine the greater this length, until a point is reached where it is more economical to reduce the reaction per pole by an increase in the number of poles, and thereby permit more efficient excitation across shorter air-gaps.

All standard generators are wound to give maximum voltages of 125, 250 or 550, and currents that, when multiplied by these, will make the output in kilowatts at which the dynamos are rated. While a 10 per cent lower working voltage may be used, the current must not be increased over that corresponding to the maximum voltage.

Compounding curves are never straight because of the approach of magnetic saturation in the field magnets, which is shown in the curves, Fig. 2. The iron is worked at a point just about the bend of the saturation curve, and it will be seen that the lines of force, hence the voltage, do not increase directly in proportion to the magnetizing force. This means that the voltage will not rise uniformly with increase of load, but will rise more slowly toward full load than at light load. In other words, the compounding curve sags as full load is approached.

This is partially corrected by using a peculiar shunt, which is called a compounding rectifier, in multiple with the series coil of the field. The current of the dynamo divides between this rectifier and the series coil. As the load increases the currents passing through both the rectifier and the series coil increase. The increased current in the rectifier raises its temperature, which increases its resistance considerably. The resistance of the series coil is hardly changed by the increased current because the temperature rise is low. The relative resistances of the rectifier and the series coil are therefore altered as full load comes on, and a larger proportion of the total current is compelled to pass through the series field coils. This compensates the tendency to a deficiency in the rise of the voltage. All the standard dynamos are wound alike as regards overcompounding. The amount of overcompounding when less than three per cent will be arranged to suit the specific conditions by adjusting the resistance of the compounding rectifier. Overcompounding greater than three per cent is special and must be obtained by special winding.

The high efficiency, in spite of low speed, of the 200-kilowatt size 280 dynamo (see Fig. 3, also Fig. 1) is due to excellence of design. It will be noticed that its efficiency curve looks like that of a belted dynamo, it is so high at light load. It attains 90 per cent at one-fourth load, and

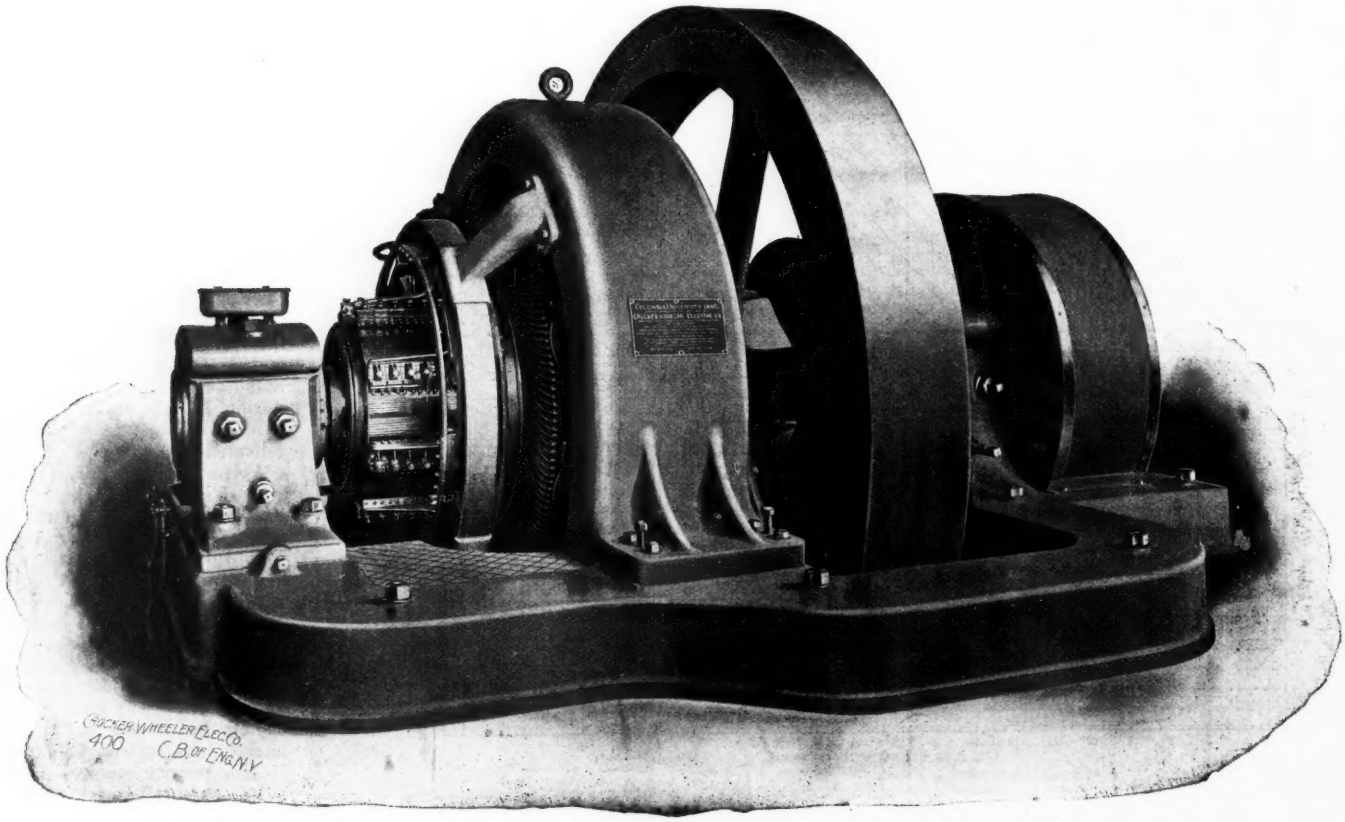


FIG. 1.—A MODERN "DIRECT" GENERATOR AND CORLISS ENGINE INSTALLED AT COLUMBIA UNIVERSITY, NEW YORK CITY.

its maximum efficiency at practically one-half load, the curve from this point to full load being almost a straight line.

If the dynamos are run faster than their standard speeds, their efficiencies will be slightly increased, owing to greater output obtained without corresponding increase in the losses. If they are run slower than their standard speeds, the efficiency will be slightly diminished. The elements of design which secure high efficiency in these machines are: Armatures large in diameter to give efficient peripheral speeds; conductors of such ample cross-section as to waste little energy; moderate magnetic densities, and such relations between conductors, teeth and air-gaps as reduce the losses from foucault currents to a minimum.

All these dynamo armatures have toothed cores. The slots have parallel sides with rounded bottom and very narrow opening at the top. This compels the winding to be threaded through from the ends.

The commutator, the most costly part of an armature, has received the closest and most careful study in its design. The bars are made of the best hard-drawn copper, with copper tails riveted, as well as sweated, into one end. These tails are made sufficiently long to keep the soldered joints with the armature conductors cool, even though the commutator bars should become overheated from any cause, and are arranged so as to permit free circulation of air between them.

The larger sizes of commutators have their bars held down by sectional collars, each section of which covers but four or five bars. The object of this is to make it possible to bring equal pressure to bear on all the bars by individual adjustment of the parts of the collars, which are drawn toward the center by wedges operated by screws at the ends of the commutator. It is obvious that repairs

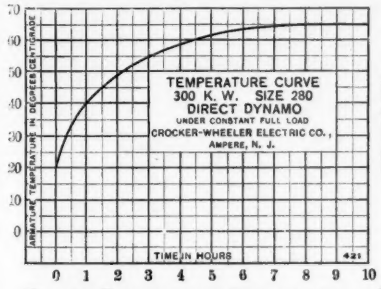


Fig. 4.—Temperature Curve with Constant Load.

are facilitated, since one or more bars can be taken out without disturbing the others by removing the sections of the collars which hold their ends.

The connecting of shunt dynamos in parallel is a very simple matter, since, if the two machines are not of exactly the same voltage when thrown in multiple, no harm will be done, because two shunt machines in parallel tend to steady each other. But the running of compound dynamos in parallel is more difficult and requires much greater care, on account of the effect of the series field-coils. The terminals which are not connected directly to the line, but which are connected to one end of the series coil, should be joined together by an equalizer, which is usually connected to the middle contact of a three-pole main switch, the other two poles of which control the connections of the mains. The cross-section of this equalizer must be at least one-half that of a main.

When two dynamos of different

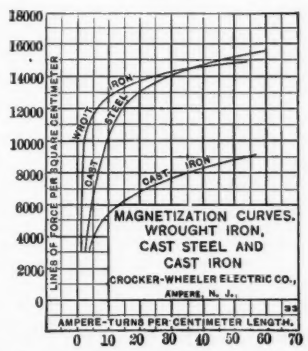


Fig. 2.—Magnetization Curves.

sizes are run in parallel, it is necessary that the resistances of the series field-coils shall be inversely proportional to the current capacities of the machines. In other words, if one dynamo carries twice as much current as the other, its series coil should have half the resistance of the other's series coil. It is also necessary that the compounding curves of the two machines should agree; a given percentage of change of load should have a proportional effect upon their voltages.

The Crocker-Wheeler Electric Company has adopted as its standard increase of temperature 45 degrees centigrade over the temperature of the surrounding atmosphere, and it is absolutely within the limits of safety after deducting an extremely large

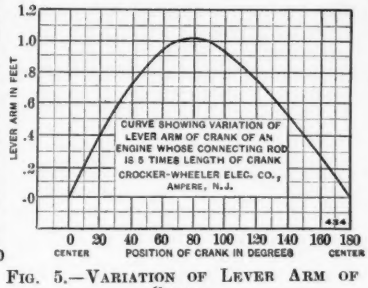


Fig. 5.—Variation of Lever Arm of Crank.

margin. It is well known that a temperature of 100 degrees centigrade, corresponding to the boiling point of water, is absolutely safe for insulation; in fact, the limit is considerably higher than this. Therefore, when a rise of no more than 45 degrees is permitted, it shows that the temperature of machines may be more than doubled before they come near to the limit of safety.

As a dynamo absorbs power evenly at all points in its revolution, while the driving effort from an engine is pulsatory, a slight flicker is caused in the current generated, which will be noticeable, unless means are provided for keeping it sufficiently small. Take as a simple case a single cylinder, double-acting engine. As the power is delivered by the engine twice in a revolution while it is absorbed at a uniform rate at all times, the dynamo slows down to some degree between engine strokes, causing a corresponding fluctuation in the current gener-

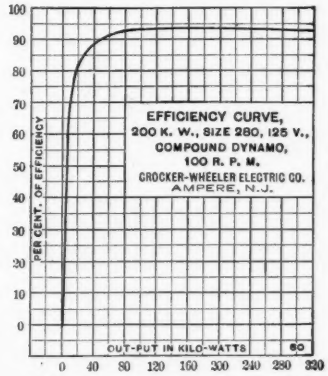


Fig. 3.—Efficiency Size 280.

ated. A variation of more than one-half of one per cent, or one-half volt in an incandescent lamp, being visible, a flywheel must be used of sufficient weight to prevent the dynamo slowing down more than one-half of one per cent whenever lamps are to be supplied from a single dynamo without other dynamos to keep the pressure even. This weight must be determined as follows:

The turning power imparted by the engine varies first with the varying leverage value of its crank, which gives no power when the engine is on its "centers," and gives full power at a point near half stroke, as indicated by the curve shown in Fig. 5.

It varies again in consequence of the changing steam pressure resulting

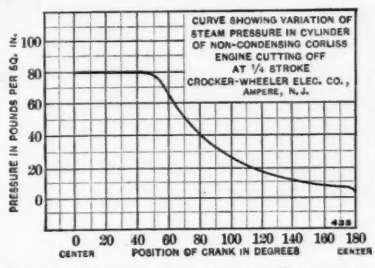


Fig. 6.—Variation of Steam Pressure in Cylinder.

from the expansion behind the piston. Assuming that the engine cuts off at quarter stroke, the variation of pressure will be as indicated by the curve in Fig. 6.

Combining these, gives the actual power supplied by the engine, varying as shown by the curve in Fig. 7, an examination of which shows that the fluctuation of energy in every stroke, namely, that which the flywheel has to absorb and give out twice in each revolution, is 38 per cent of the total power of the engine.

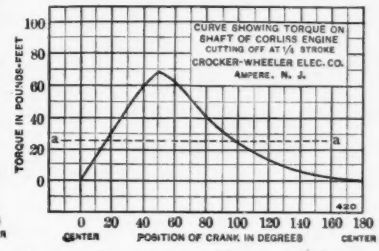


Fig. 7.—Variation of Torque on Shaft of Engine.

A Brazilian Indian Telephone.

Mr. José Bach, in a narrative of his travels among the Indians of the regions of the Amazon, describes in *L'Illustration* an instrument by means of which these people communicate with each other at a distance.

These natives live in groups of from 100 to 200 persons, and in dwellings called "maloccas," which are usually situated at a distance of half a mile or a mile apart.

In each malocca there is an instrument called a "cambarisa," which consists essentially of a sort of wooden drum that is buried for half of its height in sand mixed with fragments of wood, bone and mica, and is closed with a triple diaphragm of leather, wood and india-rubber.

When this drum is struck with a wooden mallet, the sound is transmitted to a long distance, and is distinctly heard in the other drums situated in the neighboring maloccas. It is certain that the transmission of the sound takes place through the earth, since the blows struck are scarcely audible outside of the houses in which the instruments are placed.

After the attention of the neighboring maloccas has been attracted by a call blow, a conversation may be carried on between the cambarisas designated.

According to Mr. Bach, the communication is facilitated by the nature of the ground, the drums doubtless resting upon one and the same stratum of rock, since transmission through ordinary alluvial earth could not be depended upon.

We have here an ingenious improvement upon the process employed by Indians for perceiving distant noises (such as the gallop of a horse), and which consists, as well known, in applying the ear to the earth. This method was formerly much used by the people under consideration during the course of wars of one tribe with another.—*Scientific American.*

Toronto, Ont.—The Metropolitan Street Railway is reported to be considering the extension of its road to Schomberg.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

RONCEVERTE, W. VA.—The Greenbrier & Pocahontas Telephone Company has been incorporated, with a capital stock of $10,000; capital subscribed, $1,500; amount paid in, $150.

EDINBURG, IND. — The Citizens Telephone Company has been incorporated, with a capital stock of $1,500.

NORRISTOWN, PA.—The Delaware & Atlantic Company are constructing a new telephone line between Norristown and Pottstown.

IRON CITY, TENN.—The Lawrence Telephone Company has been organized for the construction of a telephone system.

HAVANA, ILL.—The Havana Telephone Company has been incorporated with a capital stock of $5,000; incorporators, E. T. Munger, C. T. King, O. D. Covington.

MONROE, WIS. — The Wisconsin Telephone Company has completed its long distance metallic circuit from Janesville to this city, and the line is being extended to Dubuque.

TEMPLE, TEX.—The Southwestern Telephone and Telegraph Company has received a carload of material at this place for the construction of another territorial line between this place and Belton. There are now two lines between the two places, but the great amount of business between them requires another, which will be erected.

NACOGDOCHES, TEX.—This city is soon to have direct telephone connection with Shreveport, which is about 100 miles northeast of here. The line is being rapidly constructed from here, and has passed the towns of Appleby, Garrison, Timpson and Teneha, going next to Logansport, which place was recently almost wiped out by fire.

KANSAS CITY, MO.—October 1 of this year will find this place in direct communication with St. Louis by telephone and the facilities for talking with Chicago and New York much improved.

LEWES, DEL.—The Diamond State Telephone Company will open an office in the Wolfe Building adjoining the custom-house. Miss Olga Amendsen will have charge of it.

JACKSON, MISS.—The Silver Creek Telephone Company has been incorporated with domicile at Yazoo City, Miss.; capital stock is $1,000; incorporators, R. M. Beaman, Smith & McDonnell, T. W. Fisher, R. R. Carloss, J. P. Moore, J. S. Reid, Geo. Reid, R. A. Parker, Yazoo Cotton Company, S. R. Upshaw, J. D Upshaw, Warren & Montgomery Brothers, W. B. Thomason, Campbell & Stubblefield, E. S. Crane, L. Levy, Dr. Calsay, J. R. Lampeth, F. E. Johnson, Commercial State Bank.

WEST UNION, W. VA.—The West Virginia Telephone Company, of this place, are now erecting lines to Parkersburg, where they will put in an exchange and build their line on direct to Elizabeth and other points in Wirt County.

CARLYLE, ILL. — The telephone line has been completed to Buxton, four miles west of this city. Communication was opened last week. The setting of poles for the local exchange in this place has been commenced. Promoter Knapp, the head of the company, has already made contracts for 25 'phones to be placed in the various business houses and residences in this city.

ROCKLAND, ME. — The Rockland & Vinalhaven Telephone Company have completed their connection with Tenant's Harbor.

WILLIAMSBURG, VA.—A telephone line from Lee Hall, a station on the Chesapeake & Ohio Railroad, in Warwick County, was opened last week to Yorktown, a distance of six miles.

CHEYENNE, WYO. — The North Park Telephone Company have filed articles of incorporation with the Secretary of State. The capital stock is $15,000. The incorporators are: Monte Blevins, J. S. Mosman, G. F. Scott, C. E. Mosman, M. A. Ward. The company will operate a telephone line between Walden, Colo., and Laramie, Wyo.

Electric Light and Power.

JACKSON, MISS. — The Jackson Light, Power and Railroad Company has been incorporated by S. T. Carnes, H. H. Corson and others; capital stock, $150,000.

THIBODEAUX, LA. — The Mayor may be addressed for information concerning electric light plant.

ST. LOUIS, MO. — The Empire Heating and Lighting Company has been incorporated; capital stock, $5,000; incorporated by S. L. Cohen, J. S. Costella and J. C. Robertson.

BRADDOCK, PA.—Steps are being taken to construct a municipal electric light plant.

MT. PLEASANT, MICH.—A movement is on foot to issue $7,000 bonds for an electric light plant.

MINNEAPOLIS, MINN. — F. W. Cappelen, City Engineer, may be addressed concerning the establishment of an electric light plant.

CLARKSBURG, W. VA.—A movement is on foot to erect an electric light and power plant.

NEVADA, MO.—J. B. Quigley & Company have been granted franchise for the erection of an electric light and gas plant.

SHELBINA, MO.—The Mayor may be addressed concerning bonds to the amount of $5,000, which have been issued for the purpose of increasing the power of the electric light plant.

LUMBERTON, N. C. — Steps are being taken to establish an electric light plant in this city.

HAMBURG, ARK.—The Arkansas Improvement Company contemplates the erection of an electric light plant and the construction of a system of waterworks.

FORSYTH, GA.—John H. Anderson may be addressed concerning establishment of an electric light plant.

WINONA, MISS.—The Blackston Mercantile Company may be addressed concerning establishment of electric light plant.

New Electric Railways.

BUFFALO, N. Y.—A certificate of consolidation of the Buffalo, Tonawanda & Niagara Railroad Company and the Tonawanda Electric Railroad Company has been filed at Albany with the Secretary of State. The consolidated road will be known as the Buffalo, Tonawanda & Niagara Falls Electric Railroad Company. The capital stock of the new corporation is $1,500,000, and its directors are Henry B. Smith and H. W. Gillett, of Bay City, Mich.; T. E. Ellsworth, of Lockport; George Sandrock, James A. Roberts and C. M. Howard, of Buffalo; James Low, of Niagara Falls; and J. A. Reed and B. S. Rand, of North Tonawanda.

COLORADA SPRINGS, COLO.—The owners of the famous cog road running up Pike's Peak have decided to change the motive power from steam to electricity. It is estimated that the cost of making the change is to be about $50,000.

HAMPTON, N. H.—Work of building the electric road from this place to the state line at Seabrook was begun September 15

NEWTOWN, PA. — An important trolley deal has been consummated whereby the interests of the Newtown, Langhorne & Bristol Electric Street Railway Company were merged with those of the Newtown Electric Street Railway Company. Ninety-five per cent of the stock of the former concern passed into the hands of Thomas P. Chambers, president of the Newtown company, who now controls both roads, which are in successful operation. Mr. Chambers is also at the head of the movement to build an electric railway from Newtown to Doylestown, which will be under the same management.

BRIDGETON, N. J.—The Bridgeton & Millville Traction Company will this week begin to build the Cedarville trolley extension.

New Incorporations.

CHARLOTTE, N. C.—The Southern Electrical Company has been organized to succeed the electrical department of the Charlotte Machine Company.

PORTLAND, ME. — The Mitchell Electric Company has been incorporated, with a capital stock of $150,000.

WESTFIELD, N. J.—The Ironclad Resistance Company has been incorporated; capital is $25,000; incorporators are Arthur W. Berresford, August P. Manning and Horace M. Williams. The company will carry on an electrical business for the purpose of supplying light, heat and motive power. The plant will be located at Westfield.

CHEYENNE, WYO.—The Buffalo Manufacturing Company, with a capital stock of $30,000, has been incorporated. The incorporators are C. J. Hogerson, W. J. Thom and E. D. Metcalf.

NEW YORK, N. Y.—The Storage Battery Supply Company has been incorporated; capital, $12,000; directors, T. D. Bunce, F. E. Foster and W. E. Foster, of New York city.

SEATTLE, WASH. — The Eclipse Motor Company, with a capital stock of $50,000, has been incorporated.

KALAMAZOO, MICH.—The Kalamazoo Valley Electric Company has been incorporated, with a capital of $100,000, to develop the water-power of Kalamazoo, Otsego, Plainwell, Allegan and Battle Creek for lighting, heating and power purposes, and also for electric street car lines.

PORTLAND, ME.—F. L. Merrill Company has been organized at this place for the purpose of dealing in hardware and electrical supplies, with $10,000 capital stock, of which $300 is paid in.

ALBANY, N. Y.—The Dowd Electrical Company has been incorporated; capital, $100,000; directors, Charles Henry Fitch, of Pepperell, Mass., and others.

ELIZABETH, N. J.—The American Automobile Company, with a capital stock of $500,000, has been incorporated. The chief office of the company will be in Plainfield. It will engage in the manufacture of motors and other electrical appliances.

Increase of Capital.

LANSING, MICH.—The Peninsula Electric Light and Power Company, of Houghton, has increased capital from $150,000 to $200,000.

ALBANY, N. Y.—The American Telephone and Telegraph Company, of New York city, has filed with the Secretary of State a certificate of increase of capital stock from $20,000,000 to $25,000,000. The debts of the company are $3,091,106.

LITERARY.

The editors of *McClure's Magazine* have secured for the October number a "human document" of the recent war of the highest interest and value. It is a diary kept by the British consul at Santiago de Cuba from the day before the arrival of Cervera's fleet until the day after the American army took possession of the city. Mr. Ramsden, the author, had been British consul at Santiago for nearly 40 years. During the siege he was the special guardian and adviser of the panic-stricken foreign residents, and was in close confidential communication with the Spanish authorities, civil and military. Under the great labors and hardships of his position he finally fell ill, and, soon after the surrender, died.

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED SEPTEMBER 20, 1898.

610,887 Automatic circuit-breaking switch; W. F. Bossert, Utica, N. Y.—An electrical catch for securing the switch in open position, the said catch being operated by a normally open subcircuit closed by the switch in open position with reference to the main circuit.

610,894 Electric railway car track; G. J. Capewell, Hartford, Ct.—A car truck having a pair of traction wheels arranged one behind the other to run upon a single-rail track, an axle for each traction wheel, motors arranged concentric of the axles on each side of each traction wheel, and a truck frame with central recesses for the traction wheels, and a closed chamber each side for each motor, supported by the axles.

610,895 Controller for electric motors; F. E. Case, Schenectady, N. Y.—Consists of four or more electric motors, a switch for operating the motors in series or parallel as may be desired, and cut-out switches one for each motor, contacts and connections being such that when the cut-out switch for any motor is operated the remaining motors will be operated only in parallel.

610,898 Electric arc lamp; M. Harris, New York, N. Y.

610,899 Electric meter; C. D. Haskins, Newton, Mass.—Consists of an armature in shunt to the mains and field coils in series with the load, with a starting coil also in series with the armature and in shunt to the mains, and means for changing the current flow in the starting coil without affecting that in the armature circuit.

610,903 Circuit-breaker for three-wire systems; E. M. Hewlett, Schenectady, N. Y.—A series or overload coil and the trip of a circuit-breaker, an additional or auxiliary coil also acting to open the circuit, and included in another circuit controlled by a relay device.

610,904 Safety device for dynamo-electric machines; E. M. Hewlett, Schenectady, N. Y.—The combination with an electric generator, a prime mover driving the generator, a governor for the prime mover, and means controlled by the governor for interrupting the circuit of the generator.

610,908 Electric brake; J. B. Linn, Schenectady, N. Y.—A number of dynamo-electric armatures and brake mechanisms upon common axles, of means for passing the current from one armature through the field of another of the dynamo electric machines.

610,928 Electro-static measuring instrument; E. Thomson, Swampscott, Mass.

610,982 Electric locomotive; W. S. G. Baker, Baltimore, Md.

611,000 Electric coupling; J. F. McElroy, Albany, N. Y.

611,001 Electric-heating system; J. F. McElroy, Albany, N. Y.

611,006 Combined generator and steam engine; M. L. Whitfield, Memphis, Tenn.—A field magnet or pole-piece having its interior hollowed so as to constitute a piston-chamber, and having valve passages formed within said field magnet or pole-piece, with a piston and suitable valve mechanism.

611,056 Electric railway construction; W. Chapman, Pittsburgh, Pa.—In a contact rail for electric railways comprising sections insulated from the ground and from each other, guide clamps fastened to the ends of the rail sections, and insulating blocks having extensions and located between adjacent rail sections, said guide clamps having limiting stops to prevent the complete withdrawal of the insulating block extensions.

611,087 Contact finger for controllers or electric switches; T. von Zweibergk, Cleveland, Ohio.

611,088 Governing, reversing and braking controller; T. von Zweibergk, Cleveland, Ohio.

611,089 Method of, and means for, controlling and cutting out electric motors; T. von Zweibergk, Cleveland, Ohio—A series parallel governing switch, two lines leading from the governing switch to the reversing switch without passing through a motor or being grounded, and a cut-out in each of these lines adapted to open the same.

611,090 Controller; T. von Zweibergk, Cleveland, Ohio—A governing switch, a reversing switch, a reversing lever, and a disengageable connection between the reversing lever and reversing switch, and means whereby such connection is disengaged whenever the governing switch is in an operating position.

611,100 Electro-plating apparatus; H. R. Bossier, New York, N. Y.

611,142 Electric furnace; Riccardo Pignotti, Rome, Italy.

611,151 System of electrical distribution; C. F. Scott, Pittsburgh, Pa.—A system of distribution for alternating currents comprising two circuits carrying currents differing in phase, and each embodying two main conductors and a neutral or balancing conductor adapted to supply translating devices in multiple series, a fourth conductor for one of said circuits connected at one end to one of the main conductors of the other circuit and a connection between the other main conductor of the last-named circuit and the balancing conductor of the four-wire circuit.

611,162 Electric arc lamp; F. S. Worsely, London, England—An electric arc lamp provided with short-circuiting devices comprising in combination with the main coil of the lamp and its core, a piece or block of magnetizable material with which said core is adapted to come into contact and short-circuit the carbons when their proper feeding is interrupted.

611,175 Galvanic element; R. Krayn, Berlin, Germany.

611,185 Rheostat; C. H. Richardson, Philadelphia, Pa.

611,206 Circuit-interrupting device; D. M. Moore, Newark, N. J.—A break wheel of metal filled in between the contact surfaces with vitreous insulating material.

611,215 Electric controller; Sam Harris, Twinsburg, Ohio—A pair of concentric shafts, a pair of switch cylinders carried thereby, two sets of fixed fingers engaging therewith, and a single mechanism arranged to actuate either of said shafts.

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EDWARD S. DUVALL,
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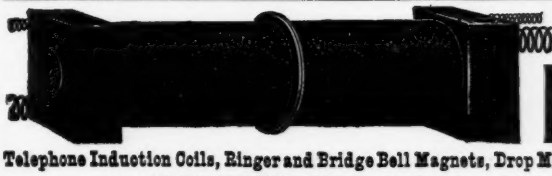
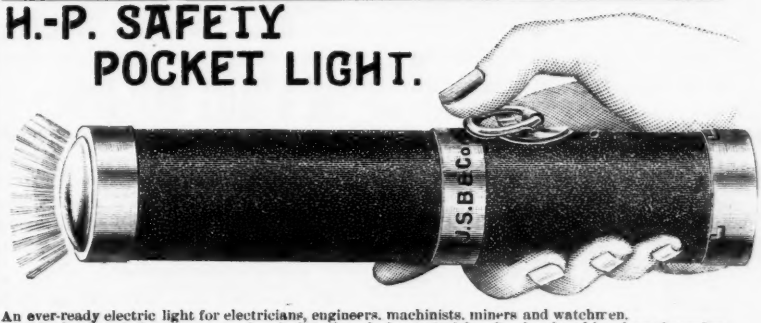


Magnets

Telephone Induction Coils, Ringer and Bridge Bell Magnets, Drop Magnets, etc., etc., also
GAS LIGHTING SPARK COILS,
THE YARLEY DUPLEX MAGNET CO., 138 Seventh Street, Jersey City, N. J.

H.-P. SAFETY POCKET LIGHT.



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CONDUCTED UNDER THE AUSPICES OF "THE ELECTRICAL ENGINEER."

Herman A. Strauss, E. E., General Manager. 120 Liberty Street, New York, U. S. A.

Kindred.... ...Interests

Dry batteries have been found very useful for signal service in the field during the war. The Western Electric Company manufactures the Western Electric dry battery, which has a high efficiency and long life, and is admirably adapted for emergencies.

The Berlin Iron Bridge Company, East Berlin, Ct., have the contract for furnishing the steel work for the Memorial Hall being erected at Westerly, R. I. This building is to be fireproof throughout, has steel floor beams and columns supporting the floor structure, and steel trusses and beams for the roof.

Hermann Boker & Company, of Duane street, New York, importers of steel, iron and metals, represent the following houses in this country: Westfalian Nickel Rolling Mill, Schwerte, Germany, manufacturers of resistance wires, tapes and sheets; Jonas & Colver, Limited, Sheffield, England, manufacturers of magnet steel; Eicken & Company, Hagen, Germany, manufacturers of piano wire.

William Roche, manufacturer of the "New Standard" batteries, 259 Greenwich street, New York, is finding quite a sale for his battery No. 2, old standard size, for telephone use. This battery is meeting with much favor among the telephone people. A very compact and attractive little battery, known as "No. 4," oval in form, size one and five eighths by one and one fourth by three and one-half, is for novelty work and is neat and excellent for such use It is particularly well adapted for electric scarf pins and similar novel battery uses.

Eugene Munsell & Company, of New York and Chicago, importers and wholesale dealers in mica, report a very gratifying demand for their India mica. They carry a large stock at both their warehouses, in New York and Chicago, and are, therefore, in a position to execute orders promptly. This concern was one of the pioneers in the preparation of mica for electrical purposes, having sold to the Edison company at a time when they were engaged in the manufacture of electrical apparatus to such an extent that they required but two armature winders, dating back in the 80's.

The Dixon Crucible Company, of Jersey City, N. J., has published a little pamphlet with the heading, "Helps in Brazing." It treats incidentally of brazing graphite. the application of which to bicycle tubes prevents the adherence of the spelter, and so effects a saving in labor by making unnecessary the filing which is otherwise needful. The pamphlet, however, especially treats of the process of brazing by the dipping method, or "liquid brazing," as it is called. The brazing crucible is described, together with instruction and caution in regard to its use. Instructions are given how to build and set the necessary furnace, time required for brazing, etc.

The electrical trade will be interested to learn of the recent arrangements made by the Western Electric Company to exclusively represent the Stanley Electric Manufacturing Company in the following territory: Michigan, Ohio, Kentucky, Tennessee, Alabama, Mississippi, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Arkansas, Louisiana, Texas, Indian Territory, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Montana, Wyoming, Colorado and New Mexico. A complete stock of transformers and other appliances to insure prompt shipment will be carried in Chicago. Correspondence is solicited from intending purchasers of alternating apparatus for any purpose—single-phase, polyphase power transmission, transformers, switchboards, instruments, etc., and all orders and inquiries will have immediate attention.

The "Cazin" water-wheel, because of the number of new features of engineering involved in its construction, has been watched by many engineers, and especially those who have studied the development of the power from waterfalls, with great interest during the past 18 months. In a recent interview with the president of the American Impulse Wheel Company, of New York, the manufacturers of this form of water-power machinery, a representative of the ELECTRICAL REVIEW was pleased to learn that the directors were fully satisfied with the showings made by the installations during the past year, and that as a result of the excellent practical demonstration of these plants, the company were this Fall getting encouragement of such a practical nature that the energies of the company's engineers were likely to be taxed to keep pace with the demands.

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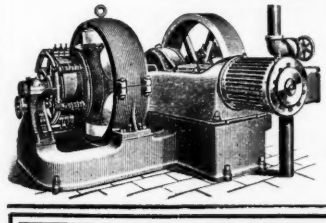

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